

# ***CHAPTER 2: ALTERNATIVES - INCLUDING THE PREFERRED ALTERNATIVE***



## ***OVERVIEW OF ALTERNATIVES***

The following three alternatives have been developed for the Seashore's Fire Management Plan DEIS:

- Alternative A (No Action) - Continued Fuel Reduction for Public Safety and Limited Resource Enhancement
- Alternative B - Expanded Hazardous Fuel Reduction and Additional Natural Resource Enhancement
- Alternative C (Preferred Alternative) - Increased Natural Resource Enhancement and Expanded Hazardous Fuel Reduction

NEPA requires project proponents to identify a range of reasonable alternatives within an EIS. Reasonable alternatives must be economically and technically feasible and demonstrate common sense. Alternatives must meet stated goals and objectives for taking action to a large degree, and must be within identified constraints. The No Action alternative must be analyzed under NEPA requirements. For this DEIS, the No Action alternative represents no change in fire management actions as they have been implemented over the past five years (1997-2001).

Initially, six alternatives were considered during development of this DEIS. Of these, three are fully analyzed in this document. The other three were considered carefully, but rejected because they would not adequately meet the fire program's objectives. These alternatives are briefly discussed in the section Alternatives Considered But Not Analyzed Further in This DEIS at the end of this chapter.

The three alternatives analyzed - Alternatives A, B, and C - meet Seashore goals and objectives to an acceptably large degree, and are within constraints imposed by regulations and policies, by risks associated with the wildland urban interface, and by technical and funding limitations. Although EIS alternatives must meet objectives and resolve planning issues to a large degree, they can vary in their methods, or in the degree to which each objective is met. This is the case in this plan, as some objectives or issues were emphasized in one alternative, and others in another.

All three alternatives involve different combinations of prescribed burning and mechanical treatments. The upper limits for both these management activities in all alternatives are a function of the risk, weather, staff, and funding limitations described in the Constraints Section of Chapter 1. As noted in that section, the use of fire on a landscape scale is not possible in the study area because of these constraints. In each alternative, an upper limit has been set on the number of acres that would be burned or mechanically treated in any one year (Table 1, based on internal scoping with park specialists in several fields. Alternative A (No Action) is based on the average number of acres treated over the past few years at the Seashore.

Table 1. Maximum Number of Acres that would be Treated with Prescribed Fire and Mechanical Treatment in Any One Year Under the Three Alternatives.

Alternative	Maximum Number of Acres		
	Prescribed Burning	Mechanical Treatment	Total
A	500	500	1,000
B	1,000	1,000	2,000
C	2,000	1,500	3,500

Alternative A (No Action - Continued Fuel Reduction for Public Safety and Limited Resource Enhancement) involves the continuation of existing practices as prescribed in the 1993 Fire Management Plan. Existing practices include mechanical hazardous fuels treatments, primarily mowing in grasslands, and limited prescribed burning, primarily for fuel reduction in grasslands and for the control of Scotch and French broom. Current research projects regarding the reduction of Scotch broom and velvet grass through prescribed burning would continue under this alternative.

Alternative B (Expanded Hazardous Fuel Reduction and Additional Natural Resource Enhancement) calls for a substantial increase over present levels in the reduction of hazardous fuels through prescribed burning and mechanical treatments. Efforts would be concentrated in areas where unplanned ignitions are most likely to occur (e.g., road corridors) and where the creation of defensible space would be most effective at containing unplanned ignitions and protecting lives and property (e.g., around structures). Natural resource enhancement would occur as a secondary benefit only. For example, in prescribed burns for fuel reduction along Highway 1, the non-native French broom would be eliminated.

Alternative C (Increased Natural Resource Enhancement and Expanded Hazardous Fuel Reduction) would result in a marked increase in efforts to enhance natural resources. Increasing the abundance and distribution of threatened and endangered species, reducing infestations of invasive, non-native plants, and increasing native plant cover would be particularly emphasized under this alternative. Burning would also be used to protect or enhance cultural resources, such as to reduce vegetation in areas identified as important historic viewsapes.

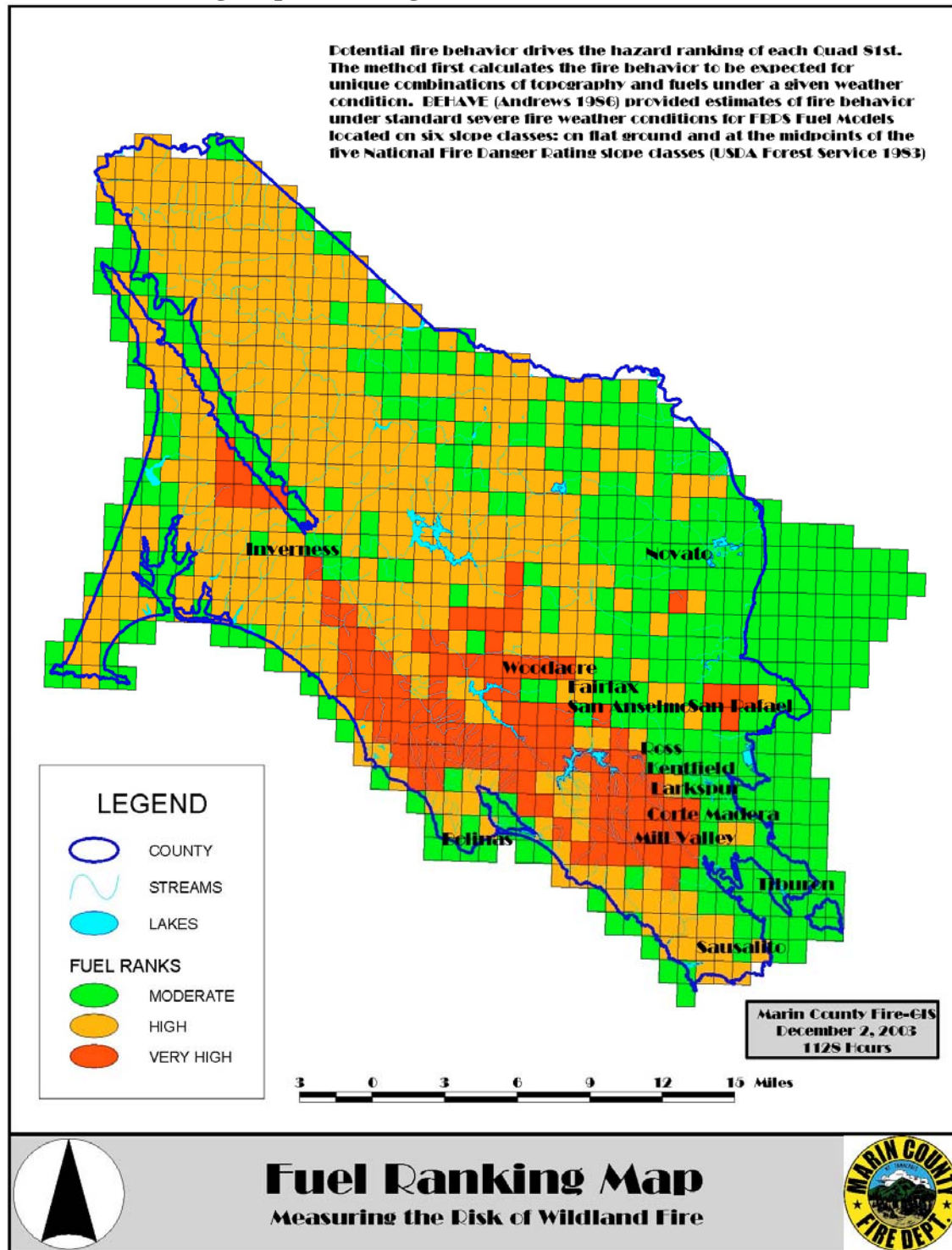
Alternative C also would include continued reduction of hazardous fuels in high priority areas (e.g., along road corridors and around structures). Under this alternative, research efforts would be expanded to determine the effects of fire on natural resources of concern (e.g., rare and non-native species) and to determine the effectiveness of various fuel treatments. Research results would be used adaptively to guide the fire management program in maximizing benefits to natural resources, while protecting lives and property.

## ***Discussion of Fire Management Units***

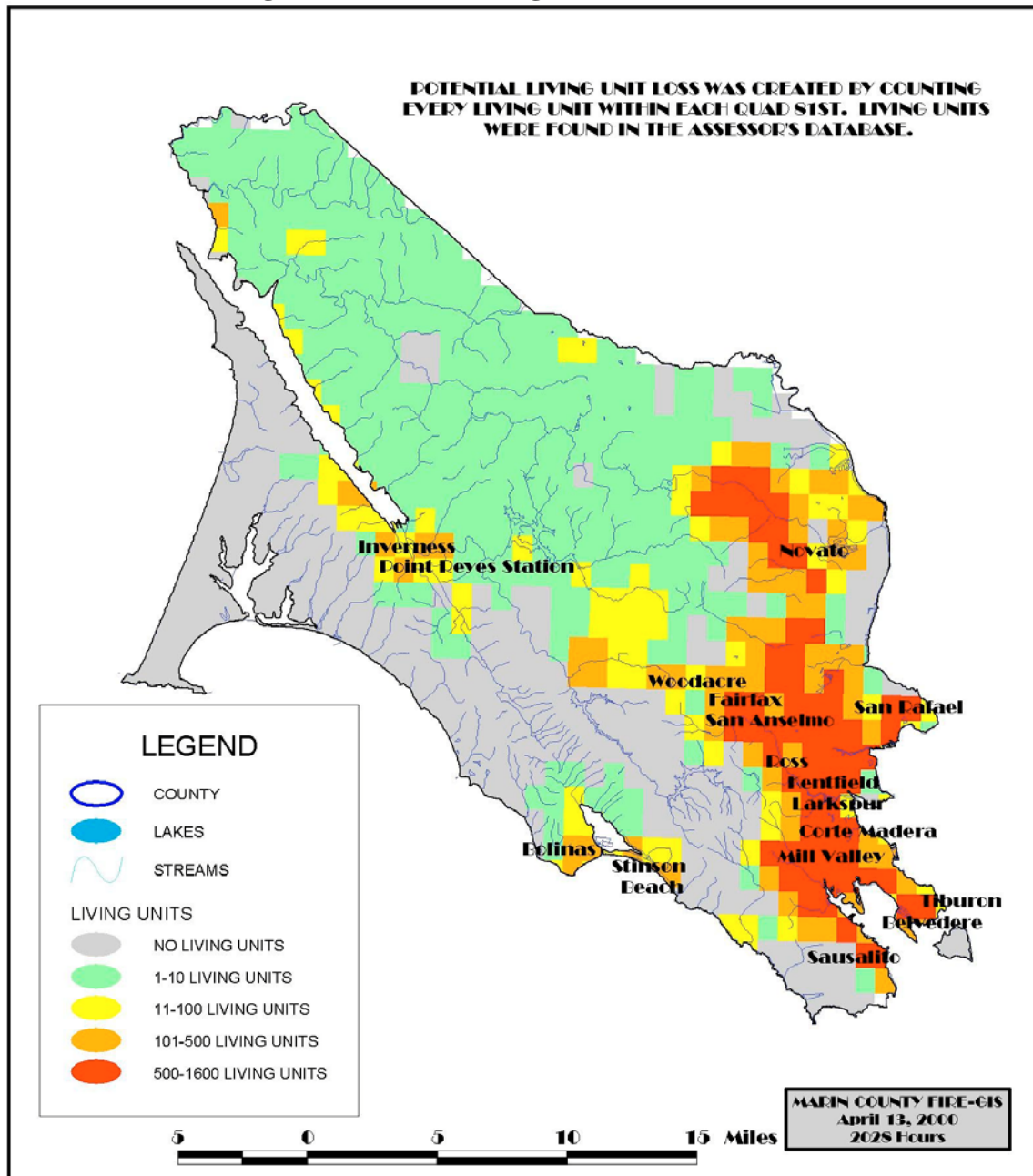
For planning purposes, the park landscape has been divided into 11 fire management units (FMUs) based on geography, fuels management and habitat enhancement needs, and on values at risk (Figure 6). Ten of these FMUs are units that may be subject to fire management actions (prescribed burning or mechanical fuel reduction treatments). The eleventh FMU - the Minimum Management Unit - includes large areas of the park that would only be subject to vegetation clearing around buildings and along roads, and full suppression of all fires.

These FMUs were developed using Marin County's Fire Plan: A Wildland Fire Risk Assessment Model (MCF, 2000) and fire professional expertise. Many FMUs such as Inverness Ridge, Wilderness North, Wilderness South, Bolinas Ridge, Highway 1, Limantour, and Palomarin are strategically located to primarily treat the highest ranking fuels (secondarily, there are resource enhancement benefits). In the event of a wildland fire, these treated areas would provide a tactical advantage to firefighters. Their treatment with defensible space, fire road clearing for emergency evacuation, and wildland urban interface programs provide a systematic effort to protect life and property. Other FMUs such as Tomales Point, Estero, and Headlands have been established primarily for resource management reasons. Three graphics – Fuel Ranking Map, Potential Living Unit Loss, and Resistance to Control (Figures 3, 4, and 5, respectively) - illustrate one aspect of the background behind establishment of the proposed FMU locations. These fire assessments, along with feasibility of access, potential for beneficial and adverse resource impacts, and the advice of fire professionals were used to develop the FMUs.

Figure 3. Fuel Ranking Map Measuring Risk of Wildland Fire



**Figure 4. Potential Living Unit Loss Measuring the Risk of Wildland Fire**



**Figure 5. Resistance of Control Measuring the Risk of Wildland Fire**

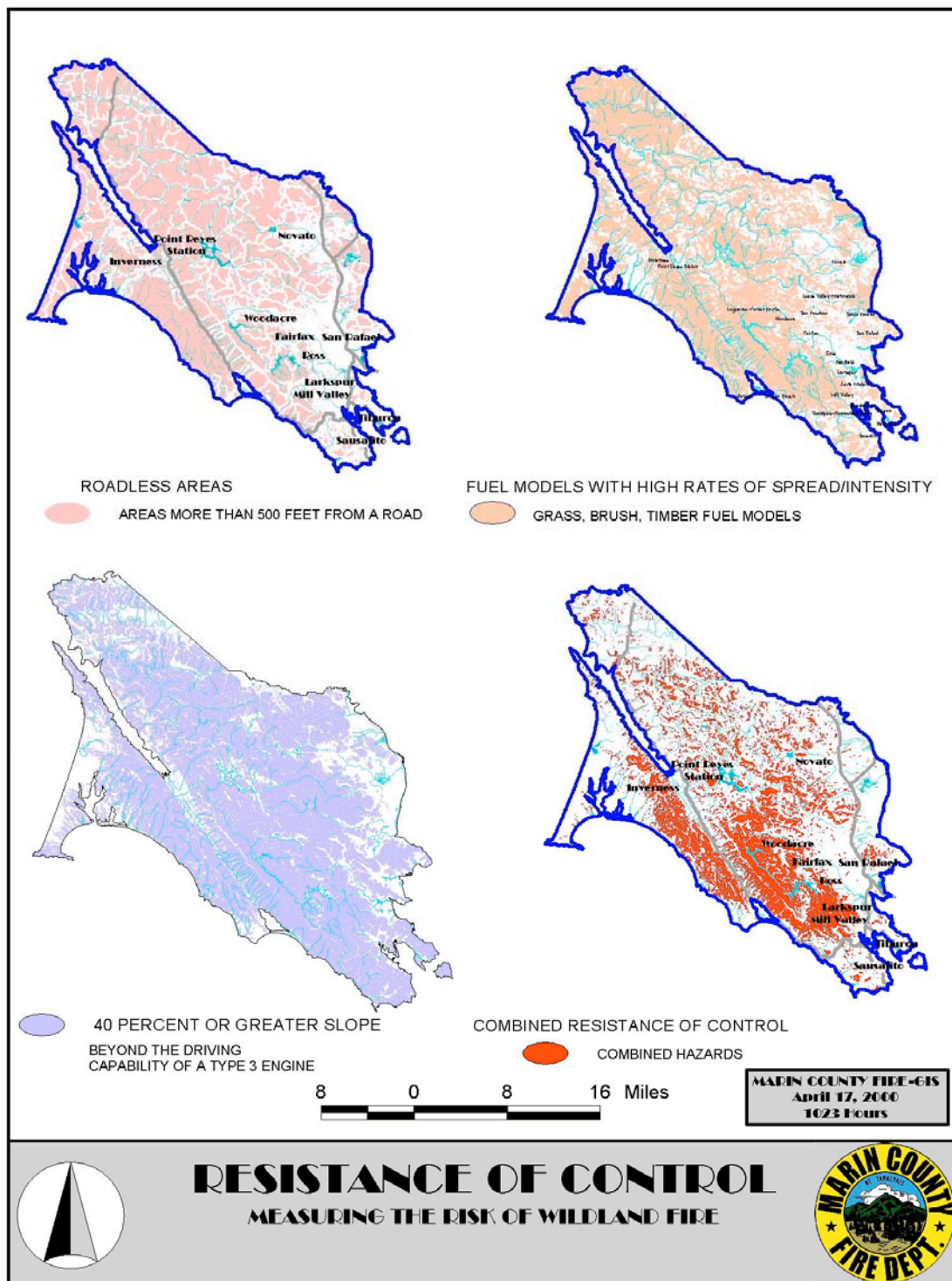
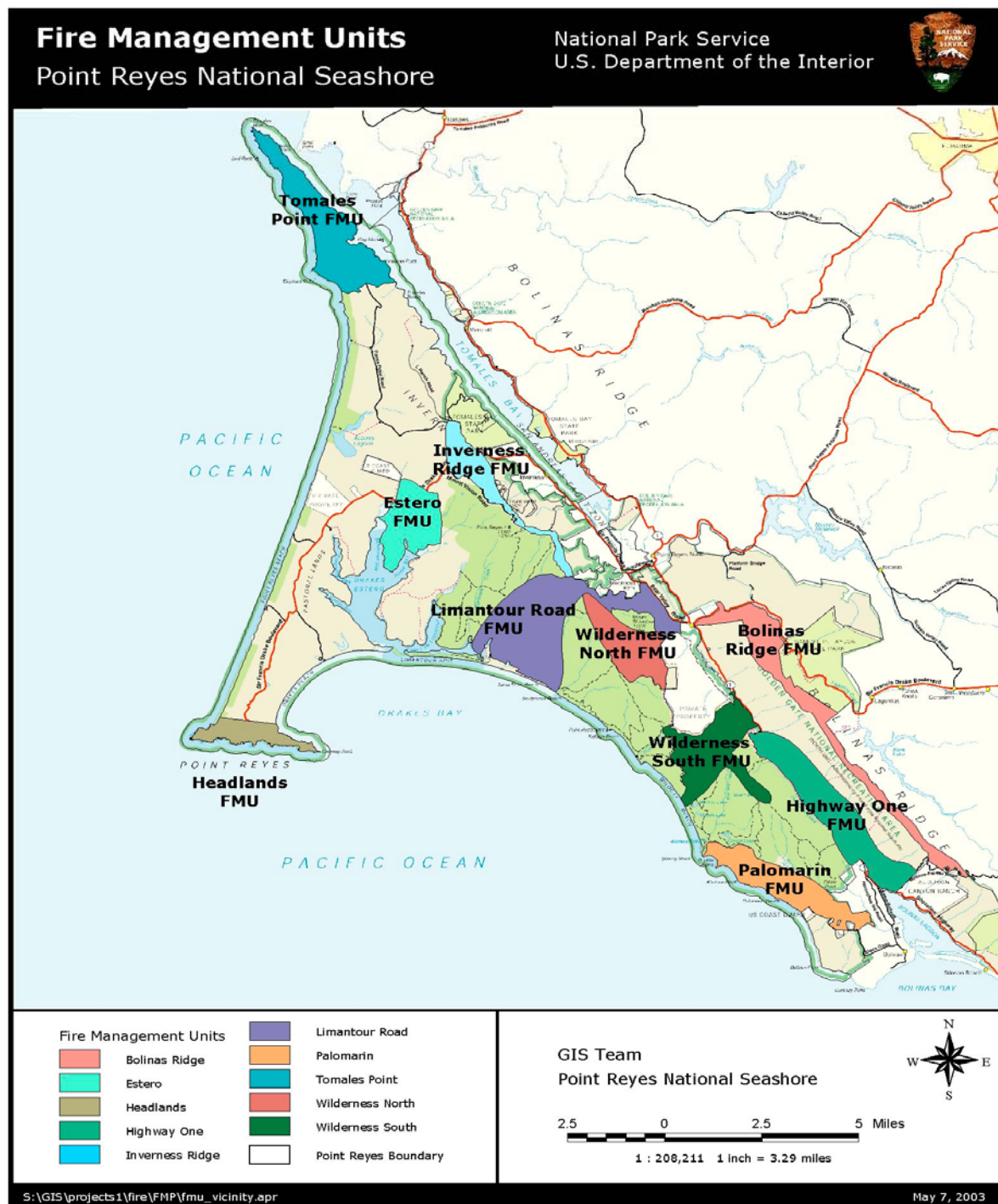


Figure 6. Map of Project Area Showing All Fire Management Units



Each FMU is addressed in the discussions of the three alternatives in this DEIS, but not all alternatives include management actions within each unit. Table 2 illustrates which FMUs could be subject to prescribed burning or mechanical fuels treatments under each alternative. Brief descriptions of the FMUs follow Table 2.

Table 2. Fire Management Units That Would Be Subject To Treatment Beyond Clearing Around Buildings Of Fire Roads And Trails (Prescribed Fire, Mechanical Treatment Or Both) Under Each Alternative.

Fire Management Unit	Alternative A		Alternative B		Alternative C	
	PF <sup>1</sup>	MT <sup>2</sup>	PF	MT	PF	MT
Tomales Point				X	X	X
Headlands					X	
Estero	X	X	X	X	X	X
Inverness Ridge			X	X	X	X
Limantour Road	X	X	X	X	X	X
Wilderness North			X	X	X	X
Wilderness South			X	X	X	X
Highway One	X	X	X	X	X	X
Bolinas Ridge	X		X		X	
Palomarin			X	X	X	X
Minimum Management <sup>3</sup>						

<sup>1</sup>Prescribed Fire

<sup>2</sup>Mechanical Treatment

<sup>3</sup> No treatments to occur except clearing of fire roads and removal of vegetation around buildings.

**TOMALES POINT** (2,781 acres) - This unit encompasses all of the land on Tomales Point north of a fence from Tomales Bay to the Pacific Ocean (in place to create a Tule elk reserve.) It supports grassland, mixed coyote brush scrub, and dense bush lupine stands at the northern tip of the peninsula. In 1978, tule elk were reintroduced to Tomales Point, and the present herd size is approximately 450 animals. Populations of ten plant species of management concern occur in this FMU; six of these are federal Species of Concern and one, Point Reyes blennosperma (*Blennosperma nanum*), is listed as rare by the state (Table 3). The historic Pierce Ranch Complex, which has grounds that support a variety of associated invasive non-native plants (e.g., eucalyptus, cape-ivy) is within this FMU.

**HEADLANDS** (881 acres) - The Point Reyes Lighthouse bluffs and Chimney Rock area at the westernmost tip of Point Reyes comprise this FMU. It contains some areas of designated wilderness along the outer bluffs. Vegetation on the unit is dominated by grassland and patches of mixed coyote brush and coastal scrub. This FMU has been subject to intense grazing pressure from cattle in the past, and currently some areas continue to be grazed, while others have been excluded from grazing. Twelve plant species of management concern occur in this FMU (Table 3); five of these are federal Species of Concern, one is state-listed as rare (Point Reyes blennosperma), and one is state-listed as endangered (Point Reyes meadowfoam - *Limnanthes douglasii* var. *sulphurea*). The Headlands harbor sensitive animal species such as brown pelican and Steller sea lions. Other sensitive animal species include nesting seabirds such as ashly storm-petrel. Marine mammals such as harbor seals are sensitive to human activities including low flying helicopters. Lands within this FMU receive very high levels of visitor use, and are popular for wildflower viewing in the spring.

ESTERO (1,638 acres) - The Estero FMU is located at the northern end of Drake's Estero, along the edges of Schooner and Home bays. This area supports primarily grassland and mixed coyote brush and poison-oak scrub habitats, with patches of wax-myrtle (*Myrica californica*) in seasonal drainages. A stand of Monterey pine occurs in the southeast corner of the FMU. The Seashore has been using prescribed fire and mowing treatments to control the non-native plant Scotch broom (*Cytisus scoparius*) in this FMU since 1993, and plans to continue with these treatments. Populations of Point Reyes mountain beaver occur in shrubby drainages within this unit. This species, although not federally listed, is of concern to Seashore managers as it is a rare species whose populations were significantly reduced by the Vision Fire in 1995. This FMU also supports nine plant species of management concern, five of these are federal Species of Concern (Table 3).

Table 3. Federal, State, and California Native Plant Society (CNPS) Listed Plant Species in each Fire Management Unit.

SPECIES		REGULATORY STATUS		
Common Name	Scientific Name	FEDERAL	STATE	CNPS LIST <sup>1</sup>
<b>Tomales Point FMU</b>				
pink sand-verbena	<i>Abronia umbellata ssp. breviflora</i>	Species of Concern	none	1B
coast rock cress	<i>Arabis blepharophylla</i>	none	none	4
Point Reyes blennosperma	<i>Blennosperma nanum var. robustum</i>	Species of Concern	Rare	1B
coastal bluff morning glory	<i>Calystegia purpurata ssp. saxicola</i>	none	none	1B
Franciscan thistle	<i>Cirsium andrewsii</i>	none	none	1B
Point Reyes bird's beak	<i>Cordylanthus maritimus ssp. palustris</i>	Species of Concern	none	1B
Marin checker lily	<i>Fritillaria affinis var. tristulis</i>	none	none	1B
San Francisco gumplant	<i>Grindelia hirsutula var. maritima</i>	Species of Concern	none	1B
rosy linanthus	<i>Linanthus rosaceus</i>	none	none	1B
Marin knotweed	<i>Polygonum marinense</i>	Species of Concern	none	3
San Francisco owl's clover	<i>Triphysaria floribunda</i>	Species of Concern	none	1B
<b>Headlands FMU</b>				
Blasdale's bent grass	<i>Agrostis blasdalei</i>	Species of Concern	none	1B
coast rock cress	<i>Arabis blepharophylla</i>	none	none	4
Point Reyes blennosperma	<i>Blennosperma nanum var. robustum</i>	Species of Concern	Rare	1B
Franciscan thistle	<i>Cirsium andrewsii</i>	none	none	1B

Marin checker lily	<i>Fritillaria affinis</i> var. <i>tristulis</i>	none	none	1B
short-leaved evax	<i>Hesperrevax sparsiflora</i> var. <i>brevifolia</i>	none	none	2
perennial goldfields	<i>Lasthenia marcrantha</i>	none	none	1B
Point Reyes meadowfoam	<i>Limnanthes douglasii</i> var. <i>sulphurea</i>	Species of Concern	Endangered	1B
North Coast phacelia	<i>Phacelia insularis</i> var. <i>continentis</i>	Species of Concern	none	1B
Point Reyes rein orchid	<i>Piperia elegans</i> ssp <i>decurtata</i>	none	none	1B
beach starwort	<i>Stellaria littoralis</i>	none	none	4
San Francisco owl's clover	<i>Triphysaria floribunda</i>	Species of Concern	none	1B
<b>Estero FMU</b>				
Blasdale's bent grass	<i>Agrostis blasdalei</i>	Species of Concern	none	1B
coast rock cress	<i>Arabis blepharophylla</i>	none	none	4
coastal marsh milk-vetch	<i>Astragalus pycnostachyus</i> var. <i>pycnostachyus</i>	none	none	1B
Point Reyes bird's beak	<i>Cordylanthus maritimus</i> ssp. <i>palustris</i>	Species of Concern	none	1B
Marin checker lily	<i>Fritillaria affinis</i> var. <i>tristulis</i>	none	none	1B
marsh microseris	<i>Microseris paludosa</i>	none	none	1B
Gairdner's yampah	<i>Perideridia gairdneri</i> var. <i>gairdneri</i>	Species of Concern	none	4
Marin knotweed	<i>Polygonum marinense</i>	Species of Concern	none	3
San Francisco owl's clover	<i>Triphysaria floribunda</i>	Species of Concern	none	1B
<b>Limantour Road FMU</b>				
Marin manzanita	<i>Arctostaphylos virgata</i>	none	none	1B
Point Reyes bird's beak	<i>Cordylanthus maritimus</i> ssp. <i>palustris</i>	Species of Concern	none	1B
California bottlebrush grass	<i>Elymus californicus</i>	none	none	4
Marin checker lily	<i>Fritillaria affinis</i> var. <i>tristulis</i>	none	none	1B
fragrant fritillary	<i>Fritillaria liliaceae</i>	Species of Concern	none	1B
Marin knotweed	<i>Polygonum marinense</i>	Species of Concern	none	3
<b>Wilderness North FMU</b>				
California bottlebrush grass	<i>Elymus californicus</i>	none	none	4
<b>Wilderness South FMU</b>				
Marin manzanita	<i>Arctostaphylos virgata</i>	none	none	1B
California bottlebrush grass	<i>Elymus californicus</i>	none	none	4

**Highway One FMU**

Marin checker lily	<i>Fritillaria affinis</i> var. <i>tristulis</i>	none	none	1B
Lobb's aquatic buttercup	<i>Ranunculus lobbii</i>	none	none	4

**Bolinas Ridge FMU**

Marin manzanita	<i>Arctostaphylos virgata</i>	none	none	1B
glory brush	<i>Ceanothus gloriosus</i> var. <i>exaltatus</i>	none	none	4
Bolinas ceanothus	<i>Ceanothus masonii</i>	Species of Concern	Rare	1B
California bottlebrush grass	<i>Elymus californicus</i>	none	none	4

**Inverness Ridge FMU**

Marin manzanita	<i>Arctostaphylos virgata</i>	none	none	1B
swamp harebell	<i>Campanula californica</i>	none	none	1B
Mount Vision ceanothus	<i>Ceanothus gloriosus</i> var. <i>porrectus</i>	none	none	1B
California bottlebrush grass	<i>Elymus californicus</i>	none	none	4

**Palomarin FMU**

Sonoma Alopecurus	<i>Alopecurus aequalis</i> var. <i>sonomensis</i>	Endangered	none	1B
Marin manzanita	<i>Arctostaphylos virgata</i>	None	none	1B
nodding semaphore grass	<i>Pleuropogon refractus</i>	None	none	4

## NOTES:

<sup>1</sup> CNPS List 1B: Rare or Endangered in California and Elsewhere

CNPS List 3: Need More Information

CNPS List 4: Plants of Limited Distribution

INVERNESS RIDGE (1,250 acres) - This linear FMU runs from the western edge of Tomales Bay State Park south along Inverness Ridge to the Bayview Trail parking area. This ridge is dominated by dense stands of Bishop pine (*Pinus muricata*) in the north, which grade into Douglas-fir (*Pseudotsuga menziesii*) forests further south. The understory vegetation is dense beneath the Bishop pine, and consists of highly flammable species such as manzanita (*Arctostaphylos* ssp.) and ceanothus (*Ceanothus* ssp.). The understory of the Douglas-fir forests can be sparse, consisting primarily of grasses and herbs, or more dense, with salal and huckleberry. This FMU supports four federal plant species of management concern (Table 3), including two federal Species of Concern - Marin manzanita (*Arctostaphylos virgata*) and Mount Vision ceanothus (*Ceanothus gloriosus* var. *porrectus*). Northern Spotted Owls, federally listed as a threatened species, nest within this FMU.

The Inverness Ridge FMU is immediately adjacent to numerous residences and several business facilities (e.g., grocery stores, restaurants, delicatessens, galleries, and shops) in the communities of Inverness and Inverness Park. The proximity of dense, flammable vegetation to these communities results in an area where the risk of loss associated with fire is very high. The Vision Fire destroyed 44 homes in this area in 1995.

LIMANTOUR ROAD (4,142 acres) - This FMU consists of a corridor along the entire length of Limantour Road from the Limantour Beach parking area, up over Inverness Ridge, and down to the intersection of Limantour Road and Bear Valley Road. Much of the unit is within the Philip Burton Wilderness Area. For management purposes, it also includes the area encompassing the Point Reyes National Seashore headquarters buildings, the Bear Valley Visitor Center, and the Coast Miwok cultural exhibit at Kule Loklo.

The southwestern portion of this FMU, from Limantour Beach to Inverness Ridge, spreads out east and west of the road to include portions of the Phillip Burton Wilderness Area. Vegetation in this area is dominated by grassland and mixed coastal scrub in the southwest, which grades into Bishop pine stands and Douglas-fir forests on Inverness Ridge. An extensive salt water and brackish marsh system occurs at the Estero de Limantour, and high quality riparian corridors are located along several northeast to southwest trending creeks (e.g., Muddy Hollow, Laguna, Coast). This section of the FMU supports six plant species of management concern, three of these are federal Species of Concern (Table 3). A free-ranging herd of 28 tule elk (which are identified in special legislation as a resource the Seashore is to protect and manage) were introduced in this area in 1999. Federally-listed threatened coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) occupy streams in this FMU.

The section of this FMU that stretches from Inverness Ridge west to the Bear Valley area supports Douglas-fir forest, mixed conifer/hardwood forest with coast live oak, California bay, coyote brush scrub, and grasslands. There are large stands of eucalyptus near the Kule Loklo site, which are highly flammable. Northern spotted owls are known to nest in both sections of this FMU.

WILDERNESS NORTH (1,591 acres) - Douglas-fir forests interspersed with small open meadows characterize this FMU, which follows Inverness Ridge southeast from the Bayview Trail parking area to the Bear Valley Trail. The terrain is characterized by steep slopes that climb up from the east and west toward the central ridge. This FMU contains Mt. Wittenberg, the highest point in the planning area at 1,407 feet. Much of the unit is within the Philip Burton Wilderness Area. This unit also contains Sky Camp, a backcountry campground. Spotted owls are known to nest in this unit. This FMU supports one plant species of management concern (Table 3) – the California bottlebrush grass (*Elymus californicus*).

WILDERNESS SOUTH (2,297 acres) - This unit is largely comprised of designated wilderness land south of the Vedanta Society property (see Figure 6). It follows Inverness Ridge south to just south of Mud Lake, and includes Firtop (1,324 ft). The unit also encompasses land southwest of Firtop, reaching to the coast at Wildcat Camp. Vegetation is dominated by dense stands of Douglas-fir with significant amounts of dead and downed material present. The southwest corner of the FMU also supports high quality stands of coastal scrub, including coffeeberry, California sagebrush, coyote brush, bush monkeyflower, and lizardtail. This FMU supports two plant species of management concern, Marin manzanita (*Arctostaphylos virgata*), and California bottlebrush grass (*Elymus californicus*; Table 3). Marin manzanita is fire dependent, and in the absence of fire, this stand has become unhealthy and cannot reproduce. Encroachment of Douglas-fir has also served to reduce direct sunlight and further the “decadent”

status of the Marin manzanita population in this part of the park. Shrubs in these stands are old and not reproducing, or dead.

**HIGHWAY ONE** (2,874 acres) - This unit begins immediately south of Five Brooks and runs along both sides of Highway One south to the Bolinas-Fairfax road. This unit includes the Olema Valley, which is characterized by the riparian corridors along Olema and Pine Gulch creeks and their tributaries. These waterways support coho salmon and steelhead trout. Above the riparian areas, the vegetation is dominated by annual grassland, mixed scrub, and hardwood communities. In many areas, the grasslands are grazed by cattle. This FMU supports dense stands of French broom and eucalyptus. Most of the unplanned ignitions that occur in the entire planning area result from car travel in this FMU.

**BOLINAS RIDGE** (2,381 acres) - This long, linear unit stretches from Olema, east along Sir Francis Drake Blvd, then turns south and follows Bolinas ridge to the Bolinas-Fairfax Road. The northern half of the unit contains grasslands grazed by cattle. Drainages within this area support mixed scrub, hardwood woodlands, and some Douglas-fir. The southern half of the unit supports primarily Douglas-fir and redwood forests, hardwood forests, and mixed scrub plant communities. At the southern end, the FMU supports a dense stand of maritime chaparral that supports two rare species (Table 3) - Marin manzanita and Mason's ceanothus (*Ceanothus masonii*). The latter species is a federal Species of Concern and is state-listed as rare.

**PALOMARIN** (2,021 acres) - Beginning in the Philip Burton Wilderness Area near Double Point, this unit follows the coastline to the southeast to the U.S. Coast Guard property, then runs inland on the northeast side of Mesa Road. This unit supports primarily mixed coastal scrub and grasslands.

The area flanking the Palomarin trailhead is characterized by an exceptional diversity of non-native plants, including eucalyptus, French broom, cape-ivy (*Delairea odorata*), pittosporum (*Pittosporum oblongata*), periwinkle (*Vinca major*), Harding grass (*Phalaris aquaticus*), kikuyu grass (*Pennisetum clandestinum*), oblong spurge (*Euphorbia oblongata*), and others. Three plant species of management concern (Table 3) are located in the Palomarin FMU.

**MINIMUM MANAGEMENT UNIT** (approximately 70,000 acres) - This unit contains all areas within the Seashore and the Northern District of GGNRA that are not included in the other ten units. This includes the majority of the pastoral zone (roughly 19,000 acres), which is dominated by grasslands grazed by cattle and large tracts of the Wilderness Area that support mosaics of forest, scrub and grassland. The Unit also includes large bodies of water such as Drakes Estero, Limantour Estero, Abbotts Lagoon, and Tomales Bay. The actions in this FMU include vegetation clearing around buildings and along roads, and full suppression of all fires.

### ***Actions Common to All Alternatives***

Some actions, including the continuation of the Wildland Urban Interface Initiative Program, maintenance of fire roads and trails, vegetation clearing around buildings, suppression of unplanned ignitions, public information and education, and fire monitoring would be carried out

under all three alternatives. Also, the park intends to build a fire cache to store equipment regardless of the alternative selected. Each of these activities is described below.

### **Wildland Urban Interface Initiative Program**

In 2001, the NPS began implementing provisions of the federal Wildland Urban Interface (WUI) Initiative program. This program was designed to facilitate cooperative ventures with park neighbors (including other federal agencies, states, counties, private landowners, and local fire agencies) to reduce the potential for wildland fire to burn from federal lands to neighboring properties.

The emphasis of this program at the Seashore is to reduce the density of hazardous fuels that create a risk to lives or property, both on and off Seashore lands. Working cooperatively with FireSafe Marin, Inc. a California 501(c)(3) public benefit corporation, PRNS has provided funding for numerous projects to reduce fuel hazards and increase fire prevention and public safety. This program would continue under all alternatives.

### **Maintenance of Fire Roads and Trails**

The Seashore routinely clears vegetation and debris from selected dirt and paved roads that provide routes for emergency evacuation and access for fire suppression activities or conducting prescribed burns, or that serve as control lines for prescribed fire projects. The minimum requirement for defensible space along roadways is 10 feet on each side. This specification provides only the minimum degree of safety for firefighters and the public and is prescribed by California Public Resource Code (PL - 4290 and 4291). An assessment of road conditions is performed in early summer, then a work plan is developed and vegetation clearing needs are prioritized.

For road clearing, trees along the sides of the roadways are limbed up to 10 feet in height as needed. Native tree species that would be limbed include Douglas-fir and Bishop pine. Trees less than four inches in diameter (dbh) are removed from 10-15 ft wide corridors on each side of the road (measured from the edge of the roadway). This width can increase to 20 feet wide where roads cross topographic saddles. Downed trees in or near the roads are cleared. Grass growing up within roads is cut or mowed. Marin County mows grasses along county-maintained roads.

Tools used for these tasks include weed-whackers, chain saws, pole saws, and a chipper towed to the site by a truck. Vegetation debris can be cut up and broadcast in the immediate area, or piled and burned. Debris that is not broadcast on site is chipped and hauled to Beebe Ranch and stockpiled. Debris piles are burned at Beebe Ranch. Chipped material is not burned.

Routine maintenance is performed on all fire roads and trails listed in Table 4 below, with the exception of Bolinas Ridge Fire Road, where it is less frequent.

Assessment and maintenance activities conducted on fire roads would include regrading where rills and gullies have formed. Where necessary, road regrading should follow standard local

practices established in the Road Maintenance MOU and the Trail Assessment document. Marin County Open Space has used this method to recontour and enhance Fire roads on Marin County Open Space District Land. This includes outslipping of roads to prevent rill and gully erosion. This is acceptable as vehicle access on fire roads is only necessary in the dry period of the year.

Table 4. Fire Roads and Trails in Pt. Reyes Receiving Annual or Periodic Maintenance

Road Name	Location
Gun Road	Inverness Ridge
Bayview Road	Inverness Ridge
Upper Vision Road	Inverness Ridge
Bolinas Ridge Fire Road	Bolinas Ridge
Limantour Road between Sky Camp and Kule Loklo	Inverness Ridge
Stewart Trail	Inverness Ridge
Randall Trail	Bolinas Ridge
Coast Trail	Limantour Area
Inverness Ridge Trail	Inverness Ridge
Sky Trail	Inverness Ridge
Mount Vision Road	Inverness Ridge
McCurdy Trail	Bolinas Ridge

## Vegetation Clearing around Buildings

Seashore staff routinely clear hazardous fuels (vegetation and flammable debris) adjacent to structures within the project area. These actions would be continued under all alternatives. Structural clearing conforms to or exceeds the requirements of California Public Resource Code (PL-4290 and 4291), which also dictates the parameters for structural safety in surrounding residential communities. This code requires a minimum 30-foot cleared buffer of defensible space around all structures.

Structural clearing projects are prioritized annually and performed in early summer. The defensible space required at each structure is based on individual site topography, and usually ranges from 30-50 feet around structures. In some cases, a larger cleared area may be required to protect the structure from potential fire hazard due to prevailing winds or the presence of drainages or swales close to the structure. Large trees are pruned or removed if the tree poses a threat, grasses are cut to stubble, and smaller trees are pruned or removed based on individual site topography. The health of all trees within the defensible space is assessed and any dead or dying trees are removed.

NPS maintenance, fire, and engineering staff conduct fire inspections of each building during the winter to assure that all structures meet fire code requirements.

## **Suppression of Unplanned Ignitions**

The current policy at the Seashore is to suppress all unplanned ignitions using minimum impact suppression tactics (MIST). These tactics will be outlined and defined in the park's operational guidelines. Since 1997, an average of three wildland fires per year have occurred at Point Reyes. All of these were kept less than ten acres in size; most were extinguished at less than one acre. To accomplish this, Point Reyes has had a 10-person Hazard Fuels Crew, 1-2 Engine Technicians, and support from the GGNRA and the Marin County Fire Department. Most of the fires occurred in the Olema Valley, and all but one were human-caused.

Fire suppression actions typically include fire line construction and laying hose. A fire line (approximately 18 to 24 inches wide) is cut and cleared to bare mineral soil using chainsaws, shovels, and other hand tools such as Pulaskis (a shovel/hoe firefighting tool) and McLeods (a scraper firefighting tool). Fire line construction can include cutting brush, limbing trees, and cutting snags.

It is also possible that, during an emergency situation where an unplanned ignition has grown to a large and dangerous fire (such as during the Vision Fire), the superintendent would authorize the use of heavy motorized equipment such as bulldozers to construct larger and longer fire lines.

Other fire suppression activities require limited off-road vehicle use by trucks, fire engines, and lowboys for hauling heavy equipment.

Air drops of retardant foam and water may occur during suppression of unplanned ignitions. Retardant foam (e.g., Phoschek) contains phosphorus. Water drops could also be made, using water from ponds in the Seashore. Helicopters will need areas to land (helispots) within the Seashore. The Seashore Aviation Management Plan addresses safe locations for landing in areas administered by the park. Temporary road and trail closures may occur during fire suppression events.

## **Public Information and Education**

A comprehensive public information and education program would be included as part of all of the alternatives. PRNS and GGNRA share a full-time fire education specialist. The program's emphases include fire safety and prevention, fuels management, the role of fire in PRNS's ecosystems, the Seashore's fire history and the cultural use of fire on the landscape, and fire research programs and opportunities. The following list illustrates several key components of the program.

Notification of fire management activities would be done prior to project commencement using road and trail signs, and postings at visitor centers, entrance stations, post offices, and other areas of high visitor use. Flyers would be distributed to residences and businesses, and posted throughout western Marin County in strategic locations (e.g., post offices) to notify the public of upcoming prescribed burns. Homeowner Associations and specific individuals would be contacted by phone or email prior to prescribed burning.

Communication with adjacent land management agencies (e.g., State Parks, Marin County, Marin Municipal Water District) would always be conducted when projects occur at or near their boundaries. They also would be notified if a project on Seashore lands has potential to affect lands under their jurisdiction.

When prescribed fires or unplanned ignitions are visible from scenic overlooks or popular visitor use areas, park interpreters or the Seashore's fire education specialist would be present to alleviate public concern and to educate visitors on the objectives and benefits of prescribed burning.

The Public or Fire Information Officer (P/FIO, respectively) would notify adjacent communities by press release, as requested, before implementing prescribed fires.

PRNS staff would follow the standard operating procedures for implementing a Fire Step-up Plan during fire season. For example, when red flag warnings are issued by the National Weather Service (Sacramento Office), fire managers would post high fire danger signs within the park.

In the event of wildland fire, the P/FIO would work closely with visiting FIOs who may be part of Incident Management Teams to assure the park message is delivered accurately and effectively. Media and public queries would receive prompt replies and would contain information about the fire, the fire management plan, and ecosystem restoration as appropriate.

## **Fire Monitoring**

Monitoring of fire effects has been occurring in prescribed burn units at PRNS since 1991. Monitoring of fuels, weather, air quality, and fire behavior for wildland and prescribed fires would generally follow the protocols outlined in the NPS Fire Monitoring Handbook (FMH)(NPS, 2003a). Under these protocols, photo points and vegetation transect data are used to assess attainment of objectives. Short and long-term objectives applicable to a specific burn area would be stated in individual Prescribed Burn Plans.

Monitoring data are archived and reviewed to refine target conditions and burn prescriptions, and to determine program effectiveness. Most of the existing FMH plots are located in Divide Meadow, the Olema Valley, Estero Trail, and southern Bolinas Ridge. Under all alternatives, these plots would continue to be monitored and additional plots would be established in any new habitat types subject to prescribed burning.

Mitigation measures to ensure the protection of cultural resources are enumerated in detail in the impact analysis in Chapter 4. Some of the larger actions the Seashore would take include monitoring to document pre- and post-burn conditions that are readily observable, such as the condition of flammable historic fabric (e.g., elements that contribute to the structure's integrity, such as original siding, shingles, etc.), preservation of milling slicks on archeological sites, visually identifiable changes in surface artifacts and surface conditions, and changes in landscape conditions in historic district and cultural landscape areas. Surveys of cultural resources would

be conducted prior to all prescribed burns. As needed, fuel loads that might threaten a cultural resource during a prescribed burn or unplanned ignition would be lightened.

Prior to prescribed burns, known cultural resources would be evaluated to the extent possible and current conditions would be assessed, using standard operating procedures. This would include documentation of current fuel loads, threats to features and artifacts, and potential for subsurface impacts through root and/or stump burn.

For wildland fires, a cultural resource specialist or resource advisor would be present during all fire management actions where recorded and unrecorded resources of interest are considered at risk. The specialist or advisor would provide documentation of fire behavior and immediately observable effects of fire in and adjacent to cultural resources. If suppression or holding actions must be taken, the specialist or advisor would help in deciding site-specific actions. Following a fire, an archeologist would revisit known cultural resources in burn areas to document fire effects and/or changes in condition and assess post-burn protection needs. Fire effects would be documented and added to the database on cultural resource fire effects.

Fire effects monitoring data will be analyzed and reviewed every five years using standard scientific analysis techniques and outside reviewers. New management questions may arise from these analyses that may require alternative strategies that are applied following the principals of adaptive management. For example, burning in areas with highly invasive non-native plants may result in enhancing the spread of the non-native species. An adaptive strategy might be to swamp the non-native seeds in the burn area with native seeds.

### **Fire Program Cache**

Currently, fire control vehicles and equipment are stored at the Hagamier Complex, located on Highway One approximately six miles south of park headquarters at Bear Valley. The current building is a former barn and has inadequate equipment storage space, no insulation or heating, poor lighting, insufficient windows, and limited office space. In addition, the majority of fire fighting staff are currently stationed at Bear Valley (Park Headquarters). This creates a delay in accessing vehicles and equipment, which increases response time to unplanned ignitions at major park assets. Storage of fire equipment and vehicles in a central location would decrease response time to major park assets and facilitate communication between park staff members responsible for fire management. Internal scoping among specialists in different fields in the park indicated the cache should ideally be located near park headquarters for logistic and technical reasons. In addition, the environmental effects of siting the building near existing buildings would be minimal. Park staff have identified a location adjacent to the roads and trails facility at the Bear Valley administrative area as its preferred choice for the cache. The site was formerly used for a trailer pad.

### ***General Description of Prescribed Fire and Mechanical Fuels Treatments***

Under all alternatives, prescribed burning and mechanical fuel treatments would be carried out to meet program goals and objectives as described in Chapter 1 (Purpose of and Need for Action). Site-specific objectives, as well as locations, size, and timing of burns and treatments would

vary, however, among the alternatives. The following sections provide detailed information on the steps that occur when a prescribed fire is implemented, and a discussion of the various types of mechanical fuel treatments that may be used under the three alternatives.

## **Prescribed Fire**

Every year fire management and resource management personnel identify priority areas for prescribed burning. Projects then are scheduled for implementation. After a project area is selected, fire personnel visit the site to define its boundaries by placing flags at the perimeter. The site may also be mapped using a Global Positioning System (GPS). After surveying for cultural resources and completing internal environmental screening for other affected physical or natural resources, a burn plan is prepared for each unit.

The burn plan estimates the percentage of the unit covered by different fuel types and of the tons of material to be burned. This information is fed into an air quality model for the burn, which is submitted as part of the application to the Bay Area Air Quality Management District (BAAQMD).

The burn plan is submitted to an outside expert, and both the expert and the park's Fire Management Officer provide a recommendation to the superintendent. After the burn plan is approved by the superintendent, the project site is prepped for the burn. To prepare for a burn in grassland habitat, a line is mowed around the perimeter of the burn by cutting grasses with either a weed whacker, mower, or tractor. In shrub or forested habitats a fire line (approximately 18 to 24 inches wide) is cut and cleared and vegetation density reduced as described above under Suppression of Unplanned Ignitions. Whenever possible, roads and trails are used as fire lines to reduce the amount of line that must be created. A hose lay is set up along the burn perimeter no more than one week prior to the burn.

If the burn is being conducted in non-native tree or shrub stands (e.g., Monterey pine or Scotch broom), the non-natives may be cut down or mowed and left in the burn unit to dry before burning. This increases mortality of the targeted non-native species.

On the day of the prescribed fire, the BAAQMD makes a final decision based on wind and weather as to whether it would permit the burn. A portable pump is set up in a pond, if available, or in a portable fold-a-tank. The pump itself is placed on the ground or on a sheet of visqueen, and is set up away from the pond to minimize off-road vehicle disturbance to the ground surrounding the pond. The foot valve is placed within a pail to prevent any debris from being sucked into the pump.

The burn is lit using a drip torch with a mixture of diesel and gasoline (3:1). This fuel is stored in a hazardous materials locker in the park and transported within the park in accordance with state and federal regulations.

During the burn, park fire staff patrol the fire line and keep it secure by watching for and suppressing any spot fires and turning any logs that could potentially roll out of the burn and spread the fire. Vehicles (pick up trucks or fire trucks) may be used to drive the perimeter to

patrol the fire. Additional fire line may be cut if required to control spot fires using hand tools or chain saws. The spot fire is extinguished using water, hand tools, and if necessary, power tools. Fire weather is carefully monitored during the burn to ensure that the conditions stay within the burn prescription.

Following the burn, the burn crew determines whether or not “mop up” is necessary to ensure that all fire is completely extinguished. Mop up activities include digging, cutting, trenching (to prevent debris from rolling), chinking (taking a pulaski and clearing burning material off a log), chunking (putting smoldering material into one pile and letting it burn up), and mixing dirt with water from backpack pumps or from hoses. Any smoldering that is causing nuisance smoke is extinguished.

Prescribed fire personnel monitor the fire until dark or until the perimeter is secured. Personnel would stay on site overnight for burns in forested habitats. The burn area is patrolled the day after burning by walking the perimeter and doing any additional mop up activities required.

### **Mechanical Fuels Reduction**

Mechanical treatment includes the following:

- Fuel breaks - clearing corridors completely of vegetation.
- Shaded fuel breaks – density of underbrush reduced; tree limbs removed.
- Mosaics of cleared areas, areas with reduced vegetation density, and uncleared area.
- Using animals to reduce fuels (cows or goats).
- Removing non-native trees and treating cut stumps with herbicide.

Every year fire management and resource management personnel identify priority areas for mechanical treatments such as mowing or hand fuels removal. Projects then are scheduled for implementation. After a project area is selected, fire personnel visit the site to define its boundaries by placing flags at the perimeter. The site may also be mapped using a Global Positioning System (GPS). Treatments are documented to ensure that a park has a historical record of the types of landscape treatments each area has been subjected to.

After the site and project environmental review process is completed, the project is approved by the superintendent with mitigations if appropriate. For example, specific appropriate mitigation measures could include leaving buffers along riparian zones and wetlands and/or creating a larger buffer around an archeological site.

If herbicides are used, they are applied according to strict specifications using detailed Material Safety Data Sheets. Any application requires the approval of the park’s Integrated Pest Manager and the Washington Office coordinator for herbicide application. No applications occur in riparian or wetland areas.

If goats or other animals are used as a type of mechanical treatment, they are closely monitored and contained by electric fences to eliminate the potential for feral animals or contamination of

adjacent water resources. Grazing treatments would be limited to the number of days needed to conduct the fuel treatment in order to minimize any potential impacts to soil or water quality.

Following the mechanical treatment, the site would be reviewed by park staff for any newly uncovered and previously unknown archeological material that may need preservation treatment. Sites would be monitored by park staff over the course of several years to review the success of the treatments. If invasive exotics are found, other treatments would be planned and implemented on the project area.

### ***Alternative A (No Action) - Continued Fuel Reduction for Public Safety and Limited Resource Enhancement***

Under Alternative A the Seashore would continue to apply existing fire management practices by implementing elements of the 1993 Fire Management Plan. Under this alternative, the Seashore would comply with the requirement of NPS Director's Order 18 to develop a new Fire Management Plan based on guidelines outlined in NPS Reference Manual 18, but the fire and fuels management actions in the new plan would not differ from current practices. The emphasis of the existing program is to use both prescribed burning and mechanical treatment to:

- Reduce hazardous fuels along primary roads (e.g., Highway One); and
- Reduce the aerial extent and density of several non-native invasive plant species including Scotch and French broom, Monterey pine, and eucalyptus trees.

Continuation of the existing fire management program and practices under Alternative A would allow the Seashore to minimally meet program goals as listed in the Fire Management Plan Goals section of the Purpose and Need chapter. Alternative A would not be as effective as Alternative C in meeting the goal to improve conditions for and protect natural resources, but would be comparable to Alternative B in the degree to which it meets this goal. The No Action alternative may also be less effective than the action alternatives (e.g., alternatives B and C) in meeting goals 6 and 7, which address public education and understanding of fire and an understanding by park staff of the specifics of fire behavior and effect inside the Seashore.

Under this alternative, a maximum of 500 acres would be subject to prescribed burning and a maximum of 500 acres would be subject to mechanical fuel treatments. Every five years, fire management and resource management personnel would develop specific plans for prescribed burning and mechanical treatments that would be subject to an NPS internal project review process. These five-year burn plans would in turn be reviewed annually and updated as needed. Fire management staff would draw from these plans to do all of the detailed work that goes into a site specific burn plan described above.

Under the No Action alternative, six FMUs (Tomales Point, Headlands, Inverness Ridge, Wilderness North, Wilderness South, and Palomarin) would not be subject to prescribed burning or mechanical treatments except those actions prescribed for the Minimum Management Unit (e.g., suppression of unplanned ignitions, mechanical vegetation clearing along roads and around

**Figure 7. Map of Project Area Showing Alternative A FMUs**



structures). This is because, as noted above, the focus of the existing fire management program (which would continue under No Action) is the management of hazardous fuels along primary roads and the reduction of non-native invasive plant species through prescribed burns and mechanical treatment. The four remaining FMUs to be treated - Estero, Highway One, Bolinas Ridge, and Limantour Road - contain primary roads and the majority of non-native broom species, as well as Monterey pine and eucalyptus (See Figure 7). The focus of treatment in each is described below:

### **Prescribed Fire**

Prescribed burning would continue to occur on a maximum of 500 acres per year within the Estero, Limantour Road, Highway One, and Bolinas Ridge FMUs. The burns could occur in any of these FMUs, but the total acres burned within the Seashore would never exceed 500 acres in any given year. The focus and intent of prescribed burns in each FMU is outlined below. Three of these units (Limantour Road, Highway One, and Bolinas Ridge) are along primary park roads where the majority of unplanned ignitions occur and the potential for a major wildfire exists. Estero FMU is included because it contains large tracts of invasive Scotch broom, the control of which is a focus of the Seashore's use of prescribed fire under the No Action alternative.

Estero - The Seashore would continue to conduct prescribed burns to contain and reduce the extent and density of the non-native plants Scotch broom and Monterey pine. Research would be conducted on the Scotch broom burn sites to determine the effects of prescribed burning on Scotch broom aerial extent and density.

Limantour Road - Prescribed burns would continue to be conducted near the Limantour Road parking area if required to eradicate Monterey pine.

Highway One - Prescribed burns would continue in the central and southern portions of the unit to reduce hazardous fuels and to control the non-native French broom.

Bolinas Ridge - Training burns would be conducted in the northern section of this FMU. Research burns to determine the effects of prescribed burning on the non-native plant velvet grass, and on two rare plant species (Marin manzanita [*Arctostaphylos virgata*] and Mason's ceanothus [*Ceanothus masonii*]) that require fire to flourish, would occur in the southern section of this FMU.

### **Mechanical Fuel Treatments**

In addition to routine clearing of hazardous fuel around structures and along fire roads, the Seashore would continue to conduct more extensive mechanical fuel treatments in the Estero, Limantour Road, and Highway One FMUs. Mechanical treatments would occur on a maximum of 500 acres per year. The treatments could occur in any of these FMUs, but the total acres treated within the Seashore would never exceed 500 acres in any given year. Some of the acres that are mechanically treated may also be burned (e.g., Scotch broom may be mowed prior to burning). The focus and intent of mechanical treatments in each FMU are outlined below.

Estero - Mowing and cutting of non-native Scotch broom and Monterey pine would continue.

Limantour Road - Monterey pine near the Limantour Road parking area would be cut.

Highway One - Grasslands would be mowed along both sides of the highway to reduce hazardous fuels and to control French broom.

### **Fire Effects and Fuel Management Research**

Fire effects research on targeted species was initiated in 1999. Studies include the effects of prescribed burning on controlling Scotch broom in the Estero FMU and velvet grass on Bolinas Ridge, and on stimulating Marin manzanita and Mason's ceanothus on Bolinas Ridge. None of the research plots were burned in 2000 due to the NPS burn moratorium. In 2001 the park burned approximately five acres of research plots as part of a study to determine the effects of prescribed fire on Scotch broom in the Estero FMU. Fire history studies using tree ring and sediment core analysis also have been ongoing in the Seashore.

Under Alternative A, research burns on velvet grass and Scotch broom would continue in order to allow Seashore ecologists to refine burning prescription parameters to control these species. Planned research burns on Marin manzanita and Mason's ceanothus would be conducted as planned to determine how best to use fire in managing these species. Research on fire history of the Seashore would continue under contract with Rocky Mountain Tree Ring Research and Northern Arizona University. Additionally, non-NPS researchers have been studying the effects of fire on plant communities and wildlife (NPS, 2003b; G. Geupel, Point Reyes Bird Observatory, pers. com.; G. Fellers, USGS-BRD, pers. com.). Northern spotted owls, dusky-footed woodrats, and land birds have specifically been targeted for study of fire effects in order to meet compliance requirements under Endangered Species Act.

### ***Alternative B - Expanded Hazardous Fuel Reduction and Additional Natural Resource Enhancement***

Under Alternative B, the Seashore's fire and fuel management program would focus on reducing hazardous accumulations of vegetation (fuels). Mechanical thinning and prescribed burning would each be used to treat a maximum of 1,000 acres, or double that of the No Action alternative. All treatments would be applied in areas where fuel reduction activities would have the highest likelihood of reducing the risk of wildland fire to lives and property. Prescribed fire and mechanical treatment would also be used to treat non-native invasive plants as it is in Alternative A, but the acreages and species treated would expand. In addition to the treatment described above for FMUs under the No Action alternative, Alternative B would focus additional treatment on the following areas:

- Sites where fuel accumulations have created situations where an unplanned fire in these fuels would directly threaten human lives or property, and
- Sites where reduced levels of fuels could help firefighters slow or stop the spread of fire in the event of an unplanned ignition, such as along Highway One.

While this alternative would meet the goals of the Seashore's fire program, it would not be as effective as Alternative C in improving conditions for natural resources. As in Alternative A,

**Figure 8. Map of Project Area Showing Alternative B FMUs**



natural resource enhancement under Alternative B would occur only as a secondary benefit in areas that were treated for fuel reduction. For example, natural resource enhancement benefits associated with prescribed burning under this alternative would include reduction of the non-native French broom in the Highway One FMU. It would, however, differ from Alternative A in that more acreage would be treated to control invasive non-native species, a natural resource objective of the Seashore.

This alternative would also not be as effective as Alternative C in achieving the goal of improving the staff's knowledge and understanding of fire inside the park. However, it would include the provision for test burns in vegetation communities where no research is currently conducted or would be conducted under Alternative A. These include Douglas-fir stands, Bishop pine forests, coastal scrub, and some grassland habitats. The results of these test burns would help Seashore staff to determine with more accuracy the prescription needed to effectively manage these vegetation types.

As in all alternatives, every five years fire management and resource management personnel would develop specific plans for prescribed burning and mechanical treatments that would be subject to PRNS's internal project review process. These five year burn plans would in turn be reviewed annually and would be updated as needed.

Under Alternative B, all FMUs except the Headlands FMU would be subject to prescribed burning or mechanical treatments as described in the following sections (See Figure 8). The Headlands FMU would be subject only to those actions that are prescribed for the Minimum Management Unit (e.g., suppression of unplanned ignitions, mechanical vegetation clearing along roads and around structures). This is because the Headlands FMU is neither a high priority area for enhancement of natural resources nor an area of major concern with regards to invasive exotic plant species.

### **Prescribed Fire**

Implementation of Alternative B would result in a substantial increase in the acres that could be subject to prescribed burning (e.g., the maximum number of acres that could be burned in any given year would double - from 500 to 1,000) when compared to Alternative A.

In many of the Seashore's habitat types, including Douglas-fir stands, Bishop pine forests, coastal scrub, and some grassland habitats, detailed site-specific information on the ecological effects of prescribed burning is not available. For example, in some areas, there is potential for the introduction of invasive non-native plants following burning. To ensure that prescribed burns are not resulting in adverse impacts, the Seashore plans to conduct small pilot project burns in these habitats, as described below, to assess actual impacts on a small-scale before proposing larger scale burns. In addition to the four FMUs where prescribed burns would take place in Alternative A, an additional four would be treated in this alternative. The eight FMUs where prescribed burns could be conducted are:

- Estero
- Inverness Ridge
- Limantour

- Wilderness North
- Wilderness South
- Highway One
- Bolinas Ridge
- Palomarin

The prescribed burns could occur in any of these FMUs, but the total acres burned within the Seashore would never exceed 1,000 acres in any given year. Most areas that would be subject to prescribed burning would be located within 0.5 miles of roads or major trails. The focus and intent of prescribed burns in each FMU is outlined below.

Estero – As in Alternative A, prescribed burns would be conducted to contain and reduce the extent and density of the non-native plants Scotch broom and Monterey pine. Current research on the Scotch broom burn sites would continue to determine the effects of prescribed burning on Scotch broom aerial extent and density.

Inverness Ridge - To date, prescribed burns have not been conducted in this FMU. Under this alternative, burns within this FMU would include small pilot projects (less than 30 acres) in Bishop pine forest to determine if such burns effectively reduce understory biomass and dead and downed fuels, and whether burning results in invasion by non-native plant species.

Limantour Road - In the past, prescribed burns have occurred within this FMU near the Limantour Beach parking area to reduce the density of Monterey pine trees. Burning in this area would continue. Additional burning would occur in grasslands and shrublands along the Limantour Road corridor to reduce hazardous fuel accumulations. This FMU also contains the area around the Bear Valley NPS Headquarters, the Bear Valley Visitor Center, and the Kule Loklo visitor use site. Small prescribed burns would be conducted in grasslands or shrublands in these areas to reduce fuel accumulations.

Wilderness North - To date, prescribed burns have not been conducted in this FMU. Initial burns would consist of pilot projects (less than 100 acres) in Douglas-fir forest and grassland near Mt. Wittenberg to determine the effectiveness of burning in these areas. The objectives of these burns would be to reduce understory biomass and stem density, to break up the continuity of ladder fuels, and to establish potential future staging areas to be used in the event of a wildfire.

Wilderness South - To date, prescribed burns have not been conducted in this FMU. Initial burns would be pilot projects (less than 100 acres) in Douglas-fir forest and grassland near Firtop to determine the effectiveness of burning in these areas. The objectives of these burns would be to reduce understory biomass and stem density, to break up the continuity of ladder fuels, and to establish potential future staging areas to be used in the event of a wildfire.

Highway One - Prescribed burns in the past in this FMU have been concentrated on grasslands that support the non-native plant French broom. Prescribed burning would continue in these areas, and would be expanded to further reduce grasses and other herbaceous fuels along both sides of the highway corridor.

**Bolinas Ridge** - In the past, prescribed burns have occurred only in the northern end of this FMU on the site of a former Christmas tree farm. Burns would continue at this site, and would also be conducted in the Beebe Ranch area, and in grasslands and shrublands along Bolinas Ridge. Grasslands along the western portion of Sir Francis Drake Boulevard would be subject to prescribed burning to create a corridor of defensible space along the road. A large portion of the northern half of this FMU is subject to grazing by cattle, which serves to reduce fuels. The area of emphasis for prescribed burning, therefore, would be on the southern half of the FMU along the Bolinas Ridge Fire Road. These burns would be conducted in cooperation with the Marin Municipal Water District. Prescribed burns in the southernmost portion of the ridge in coastal chaparral and mixed scrub habitats would also help achieve a natural resource benefit by stimulating reproduction in the rare, fire adapted species Marin manzanita and Mason's ceanothus.

**Palomarin** - To date, prescribed burns have not been conducted in this FMU. Burns would be conducted to reduce hazardous fuel accumulations and French broom populations near the Commonweal garden site and near the Palomarin Trailhead. Small-scale pilot burns also would be conducted to reduce fuels, and to discourage Douglas-fir encroachment on coastal scrub habitats around the Point Reyes Bird Observatory (PRBO) field station to create a mosaic of vegetation in the area and improve habitat for birds. Burns in coastal scrub would generally be less than 100 acres and used in part to determine effects.

### **Mechanical Treatments**

Implementation of Alternative B would result in a substantial increase, when compared to Alternative A, in acres subject to mechanical treatments to reduce hazardous fuel accumulations, and to create and maintain defensible space and fuel breaks (i.e., the maximum number of acres that could be treated in any given year would increase from 500 acres to 1,000 acres). In addition to the three FMUs where mechanical treatment would be used under Alternative A (Estero, Limantour, and Highway One), the Seashore would treat fuels more extensively in five additional FMUs. These treatments would be more extensive than the routine clearing of hazardous fuels around structures and along fire roads identified above in Actions Common to All Alternatives. The eight that would receive this additional mechanical treatment are:

- Tomales Point
- Estero
- Inverness Ridge
- Limantour Road
- Wilderness North
- Wilderness South
- Highway One
- Palomarin

The treatments could occur in any of the FMUs listed, but the total acres treated within the Seashore would never exceed 1,000 acres in any given year. Some of the acres to be mechanically treated would be the same acres that are subject to prescribed burning (e.g., Scotch broom may be mowed prior to burning). The focus and intent of mechanical treatment in each FMU are outlined below.

Tomales Point - Eucalyptus and Monterey cypress trees around Pierce Point Ranch would be subject to cutting and stump treatment with herbicides.

Estero – In addition to mowing and cutting non-native Scotch broom and Monterey pine, actions described in Alternative A, Alternative B may add cutting and stump treatment with herbicides of non-natives eucalyptus and Monterey cypress.

Inverness Ridge - A shaded fuel break may be constructed and maintained along a 3-mile long portion of Inverness Ridge. This fuel break would be constructed to reduce the risk of fire burning from Seashore lands onto adjacent private lands. Initially, a 0.25-mile section of fuel break would be constructed as a pilot project to evaluate the effectiveness of such a fuel break, and to determine and evaluate the significance of environmental effects of constructing and maintaining the fuel break. The fuel break would extend from the Bay View Trail Parking Area to the Point Reyes Hill and would be approximately 50-60 feet wide. Within the fuel break, dead and downed woody debris would be reduced by 60%, trees would be limbed up to 10 feet in height, trees up to 4 inches in diameter would be thinned, and brush would be cut in a mosaic pattern to break up fuel continuity.

Limantour Road – As in Alternative A, non-native Monterey pine near the Limantour Road parking area would be cut. In addition, areas along Limantour Road would be subject to vegetation clearing. Trees along the sides of the road, primarily Douglas-fir, would be limbed up to a height of 10 feet. Trees less than four inches in diameter (dbh) would be removed from a corridor 10 - 15 feet wide on each side of the road (measured from the edge of the roadway). This dimension could increase to 20 feet wide where the roadway crosses a saddle. Downed trees in or near the roadways would be cleared. Grasslands along the road would be mowed.

Wilderness North - Under this alternative, prescribed burns up to 100 acres in size would be conducted in this FMU. Douglas-fir forests would be subject to mechanical thinning prior to prescribed burning if such action is deemed necessary to enhance the ecological value of the burn and to ensure the burn can be conducted safely.

Wilderness South - Under this alternative, prescribed burns up to 100 acres in size would be conducted in this FMU. Douglas-fir forests would be subject to mechanical thinning prior to prescribed burning if such action is deemed necessary to enhance the ecological value of the burn and to ensure the burn can be conducted safely.

Highway One – As in Alternative A, grasslands along the highway would be mowed to reduce hazardous fuels, to create a corridor of defensible space along the highway, and to control French broom. In addition, Alternative B would include thinning or removal of non-native eucalyptus stands near McCurdy Trail, Dogtown, Hagmeier, and possibly at other locations in this FMU.

Palomarin - Areas along the road would be subject to vegetation clearing. Trees along the sides of the roadways would be limbed up to a height of 10 feet. Trees less than four inches in diameter (dbh) would be removed from a corridor 10 - 15 feet wide on each side of the road (measured from the edge of the roadway). This dimension could increase to 20 feet wide where

the roadway crosses a saddle. Downed trees in or near the roadways would be cleared. Grasslands along the road would be subject to mowing. Douglas-fir encroaching into coastal scrub near the PRBO Palomarin field station would be cut before this site is burned.

### **Fire Effects and Fuel Management Research**

All of the same research described under Alternative A, such as effects of prescribed burning on Scotch broom, velvet grass, Marin manzanita, and Mason's ceanothus would take place in this alternative as well.

As in Alternative A, research on fire history of the Seashore would continue under contract with Rocky Mountain Tree Ring Research and Northern Arizona University. However, new research would be initiated under this alternative to determine the effectiveness of mechanical treatments (e.g., shaded fuel breaks) at reducing hazardous fuel loads and the effects of such treatments on ecosystem elements. In addition, Alternative B includes the use of small test burns in vegetation communities such as Douglas-fir forest and coastal scrub to determine its effects. Specific research topics that could be included under this alternative include the following:

Inverness Ridge - the effects of prescribed burning on Bishop pine populations and associated plant species within the Bishop pine community would be evaluated.

Wilderness North – the effects of prescribed burning on Douglas-fir forest communities would be evaluated.

Wilderness South - the effects of prescribed burning on Douglas-fir forest communities would be evaluated.

Bolinas Ridge - the effects of prescribed burning on coastal grassland and chaparral plant communities would be evaluated to determine if fire can be used to increase native species richness and/or density.

Palomarin – the effectiveness of prescribed burning at reducing density or diversity of non-native plants would be assessed; the effects of prescribed burning and mechanical treatments on birds would be assessed in conjunction with the Point Reyes Bird Observatory.

General Research - researchers would continue to study the effects of fire on plant communities and wildlife (G. Geupel, Point Reyes Bird Observatory, pers. com.; G. Fellers, USGS-BRD, pers. com.). Northern spotted owls, dusky-footed woodrats, and land birds would continue to be specifically targeted for study of fire effects in order to meet compliance requirements under Endangered Species Act.

### ***Alternative C - Increased Natural Resource Enhancement and Expanded Hazardous Fuel Reduction***

Alternative C is designed to provide the fire and fuel management program with maximum flexibility in the application of management treatments. This alternative would include all activities described in Alternative B, plus additional activities designed to protect and enhance

natural and cultural resources in the Seashore. Research activities would increase over the other alternatives. Prescribed burns and mechanical treatments would emphasize the following:

- Reduction of hazardous accumulations of vegetation (fuels) in areas where these activities would have the highest likelihood of reducing the potential risk of wildland fire to lives and property;
- Enhancement of the conditions of natural resources (e.g., increasing abundance or distribution of T&E species; reducing infestations of invasive, non-native plants; increasing native plant cover); and
- Protection or enhancement of cultural resource elements and values (e.g., burning would be used to reduce vegetation in areas that are identified as important historic views).

As with other alternatives, Alternative C would meet the goals of the Seashore's fire program as stated in the Purpose and Need chapter. Of all alternatives, Alternative C would most fully meet the goals of maintaining or improving the condition of natural resources (goal 3) and improving both the knowledge of fire and refinement of fire management practices through research and monitoring (goal 7). In addition, because it includes treatment over many more acres than the other alternatives, Alternative C would meet the goals of protecting public safety (goal 1) and property (goal 2) to a greater degree.

Under this alternative, a maximum of 2,000 acres would be subject to prescribed burning and a maximum of 1,500 acres would be subject to mechanical treatments. As in other alternatives, every five years fire management and resource management personnel would develop specific plans for prescribed burning and mechanical treatments that would be subject to NPS internal project review process. These five-year burn plans would in turn be reviewed annually and updated as needed. Under Alternative C, all FMUs would be subject to prescribed burning (See Figure 9).

### **Prescribed Fire**

Implementation of Alternative C would result in a substantial increase in the acres that could be subject to prescribed burning. As noted above, the maximum number of acres that could be burned in any given year would quadruple compared with Alternative A and double compared with Alternative B.

Limited information currently exists on the natural frequency (e.g., without any human influence) of lightning fires in the Seashore. In addition, accumulations of fuel in many areas far exceed what would have been present if the ecosystems had been burning at regular intervals. Therefore, prescribed burns intended for resource enhancement initially would be small and would be subject to intensive monitoring and research. If research results indicated that ecological conditions were improving after prescribed burns in certain habitat types, the size of prescribed burns in these habitat types could increase.

Similar to Alternative B, this alternative includes small pilot project burns in habitats where the ecological effects of burning are not fully understood. These include Douglas-fir stands, Bishop pine forests, coastal scrub, and some grassland habitats. The focus for prescribed burns under this alternative would be on areas where Seashore ecologists feel ecosystem health would be enhanced by burning and on areas where fuel accumulations create fire hazards. To the extent it is possible, prescribed burns would be conducted to approximate historic natural fire intensity and fire intervals. The intent is to allow the process of fire to act on the landscape as it has for thousands of years to the greatest extent possible, while ensuring human safety and protecting property. As with the other alternatives, Alternative C would also use prescribed fire to reduce infestations of highly invasive non-native plant species. Seashore personnel may time burns at unusual times of the year (spring, for example) to increase its effectiveness by killing young plants before they reproduce.

Prescribed burns could occur in any of the FMUs, with the exception of the Minimum Management Unit. The total acres burned within the Seashore, however, would never exceed 2,000 acres in any given year. The FMUs that would be subject to prescribed burning in Alternative C that are not burned in any other alternative include Tomales Point and Headlands. Most areas that would be subject to prescribed burning would be located within one mile of roads or major trails. The focus and intent of prescribed burns in each FMU are outlined below.

**Tomales Point** - The Tomales Point FMU supports a population of approximately 450 tule elk (N. Gates, personal communication) and a suite of 11 plant species of special concern (Table 3). No fire history data have been collected from the immediate vicinity of Tomales Point, but it can be inferred from fire history data collected elsewhere in the Seashore that this FMU has been subject to periodic fire through time. The plant species composition of the grasslands in this FMU includes a mixture of native and non-native grasses and herbs, with scattered patches of coastal scrub dominated by coyote brush (*Baccharis pilularis*) and lupine (*Lupinus arboreus*). Based on results of research conducted in other California grasslands, application of prescribed fire may encourage establishment of a larger proportion of native species than presently occur there. Small prescribed burns would be conducted in the Tomales Point FMU and would be carefully monitored to determine the response of the plant communities, including the plants of special concern, to fire. Additional benefits of fire in creating habitat and forage for tule elk and host plants for Myrtle's silverspot butterfly are also possible.

Studies would also be conducted on these burn units to determine the response of the invasive non-native velvet grass to prescribed burning at different times of the year. Velvet grass is a highly invasive, non-native, perennial, rhizomatous grass that has been increasing in aerial extent and density in many areas of the Seashore, and has been identified by the park's Exotic Plant Management Plan (NPS, 1989) as a priority for management.

**Headlands** - Prescribed burns have not been conducted in this FMU in the past. Although fire history data have not been collected in this area, it is unlikely that this area has historically burned frequently due to the prevailing fog and moist conditions occurring most of the year. Small, prescribed burns would be applied in this FMU on a trial basis to determine if fire can be

**Figure 9. Map of Project Area Showing Alternative C FMUs**



used to reduce the aerial extent and density of invasive non-native plants such as velvet grass, and to increase the percentage of native plant species in the headlands communities.

Estero – As in alternative B, prescribed burns would be conducted to contain and reduce the extent and density of the non-native plants Scotch broom, Monterey pine, Monterey cypress, and eucalyptus. Research would be conducted on the Scotch broom burn sites to determine the effects of prescribed burning on Scotch broom aerial extent and density.

Inverness Ridge - The same focus of treatment as described in Alternative B would apply to the use of prescribed burns in Inverness Ridge in this alternative. Initial burns would include small pilot projects in Bishop pine forest to determine if such burns effectively reduce understory biomass and dead and downed fuels, promote regeneration of rare species reliant on fire, and do not result in invasion by non-native plant species.

Limantour Road – Prescribed burning would be used to accomplish the same objectives in this FMU as described in Alternative B. These include reducing the density of Monterey pines, reducing hazardous fuel accumulations along the road corridor, and maintaining defensible space around buildings and visitor use areas.

Wilderness North - The initial burns in this FMU would be small pilot projects in Douglas-fir forest and grassland near Mt. Wittenberg. The primary objectives of these burns would be similar to, but more expanded than in Alternative B, and include:

- Reduce or break up the continuity of the very dense fuel loads occurring in many areas of the forest; thereby reducing the chance for adverse effects associated with an unplanned ignition (e.g., potential stand-replacing crown fire, loss of homes or other structures);
- Establish areas of reduced fuel loads where fire suppression crews could be staged in the event of a wildfire; and
- Reintroduce fire into forests that have historically burned on a regular basis (estimated fire return interval: 7-14 years), but which have not burned for 50-100 years.

If small burns effectively reduce understory biomass, larger burns may be conducted in this FMU in the future.

Wilderness South - The initial burns in this FMU would be small pilot projects in Douglas-fir forest and grassland near Firtop, and in Douglas-fir forest near Mud Lake. The primary objectives of these burns are identical to those described above for Wilderness North, and are similar to, but more expanded than those in Alternative B for this FMU. If small burns effectively reduce understory biomass, larger burns may be conducted in this FMU in the future.

Highway One – Prescribed burning would be used to achieve the same objectives in this FMU as under Alternative B. These include reducing grasses and other fuels along the highway corridor and the control of non-native French broom.

Bolinas Ridge – Prescribed burning would be used to achieve the same objectives in this FMU as under Alternative B. These include creating defensible space along the Sir Francis Drake Boulevard road corridor, reducing fuels, and managing Marin manzanita and Mason’s ceanothus.

Palomarin – Prescribed burning would be used to achieve the same objectives in this FMU as under Alternative B. These include reductions of fuel and French broom, as well as control of Douglas-fir encroachment into coastal scrub habitats.

### **Mechanical Treatments**

Implementation of Alternative C would result in an increase, when compared to either Alternative A or B, in acres subject to mechanical treatments to reduce hazardous fuel accumulations and to create and maintain defensible space and fuel breaks (i.e., the maximum number of acres that could be treated in any given year would increase from 500 acres to 1,500 acres). The Seashore would use mechanical treatments in the same FMUs as in Alternative B with the same objectives or focus for treatment, but mechanical cutting and thinning would take place on more acres. The FMUs that would receive mechanical treatment beyond clearing for fire roads and trails and around buildings to create defensible space are:

- Tomales Point
- Estero
- Inverness Ridge
- Limantour Road
- Wilderness North
- Wilderness South
- Highway One
- Palomarin

The treatments could occur in any of these FMUs, but the total acres treated within the Seashore would never exceed 1,500 acres in any given year. Some of the acres to be mechanically treated would be the same acres that are subject to prescribed burning (e.g., Scotch broom may be mowed prior to burning). The focus and intent of mechanical treatment in each FMU are outlined below.

Tomales Point – As in Alternative B, eucalyptus and Monterey cypress trees around Pierce Point Ranch would be subject to cutting and stump treatment with herbicides.

Estero – As in Alternative B, eucalyptus, Monterey pine, and Monterey cypress would be subject to cutting and stump treatment with herbicides. Scotch broom populations would be cut or mowed.

Inverness Ridge – The same actions as described in Alternative B for this FMU would take place in this alternative as well. These include the creation and maintenance of a 3-mile shaded fuel break along the ridge.

Limantour Road – The same actions as described in Alternative B, including trimming or removing trees along the road and cutting Monterey pine, would take place in this alternative.

Wilderness North – As in Alternative B, mechanical treatment would be used to thin forests prior to prescribed burning if test burns indicate burning can be conducted safely and enhances Douglas-fir in this FMU.

Wilderness South - As in Alternative B, mechanical treatment would be used to thin forests prior to prescribed burning if test burns indicate burning can be conducted safely and enhances Douglas-fir in this FMU.

Highway One – The actions described in Alternative B for this FMU would also be conducted in Alternative C. These include mowing grasslands along the highway and thinning or removal of eucalyptus.

Palomarin – As in Alternative B, Alternative C would include clearing of trees along roadways, mowing grasslands along the road, and cutting Douglas-fir encroaching into coastal scrub before these areas are burned.

### **Fire Effects and Fuels Management Research**

Under Alternative C, the fire management program would be guided continually by the results of research on the ecological effects of fire and mechanical treatments. Ongoing research on Scotch broom, velvet grass, and rare chaparral plants would continue, and research on the effects of prescribed burning would expand into additional habitat types, including coastal grassland, Douglas-fir forest, riparian woodland, and Bishop pine forest. If the results of these studies are ecologically favorable (e.g., lead to increased native species richness, create areas supporting a variety of age classes within habitat types, and/or result in increases in rare species abundance or distribution), additional prescribed burning would occur in subsequent years in those habitat types.

Under this alternative, the research program also would be expanded to include studies on the effects of mechanical fuel treatments on ecological parameters. Vegetation would be selectively removed from within Douglas-fir forests and in shrub-dominated habitats such as coastal scrub and chaparral to determine the effects of such removal on physical and biological elements (e.g., soils, selected plant species). Specific research topics that could be included under this alternative include, but are not limited to, the following:

Tomales Point - the effects of prescribed burning on coastal grassland plant communities and wildlife species would be evaluated to determine if fire can be used to increase native species richness and density, to reduce density of velvet grass, and to increase the aerial extent and/or density of rare plants.

Headlands - the effects of prescribed burning on coastal grassland plant communities would be evaluated to determine if fire can be used to increase native species - both animal and plant - richness and density, and/or to reduce density and aerial extent of non-native species.

Inverness Ridge - the effects of prescribed burning on Bishop pine populations and associated plant and animal species within the Bishop pine community (including Marin manzanita and Mount Vision ceanothus) would be evaluated as in Alternative B; the effects of prescribed burning and mechanical treatments on dusky-footed woodrats, northern spotted owls, and Point Reyes mountain beavers would be assessed.

Limantour Road - the effects of prescribed burning on the highly invasive non-native Harding grass would be evaluated; the effects of prescribed burning on the rare plant fragrant fritillary (*Fritillaria liliaceae*) would be studied.

Wilderness North – the effects of prescribed burning on Douglas-fir forest communities, including spotted owl habitat elements would be evaluated; the effects of prescribed burning and mechanical treatments on dusky-footed woodrats would be assessed.

Wilderness South - the effects of prescribed burning on Douglas-fir forest communities, including spotted owl habitat elements would be evaluated; the effects of prescribed burning and mechanical treatments on dusky-footed woodrats would be assessed; the effects of prescribed burning and mechanical treatments on the rare plant Marin manzanita would be assessed.

Highway One – the effects of prescribed burning and mechanical treatments on creeks, riparian habitat, coho salmon and steelhead, and California freshwater shrimp would be assessed.

Bolinas Ridge - the effects of prescribed burning on coastal grassland and chaparral plant communities would be evaluated to determine if fire can be used to increase native species richness and/or density as in Alternative B.

Palomarin – the effectiveness of prescribed burning at reducing density or diversity of non-native plants would be assessed; the effects of prescribed burning and mechanical treatments on birds would be assessed in conjunction with the Point Reyes Bird Observatory as in Alternative B.

General Research - researchers would expand their studies of the effects of fire on plant communities and wildlife (G. Geupel, Point Reyes Bird Observatory, pers. com.; G. Fellers, USGS-BRD, pers. com.). Northern spotted owls, dusky-footed woodrats and land birds would continue to be specifically targeted for study of fire effects in order to meet compliance requirements under Endangered Species Act. Other topics that would be researched include: presence of sudden oak death, prescribed fire influence on the distribution of common ravens, and the spreading of native seeds after a prescribed fire.

## ***Mitigation Measures***

The following mitigation measures would be applied regardless of the alternative selected:

### **General**

G-1. To ensure that implementation of fire management plan actions conforms to findings of this impact assessment, subsequent fire year plans and individual projects

would be subject to NPS project review. Prior to approval, all projects would be submitted through an NPS internal review process wherein an interdisciplinary team would evaluate if the potential effects of the proposed projects were adequately addressed through the FMP NEPA process. Conformance to the conclusions in the FMP EIS will be documented for the NEPA record. If the team finds that the project has major new environmental effects not addressed in this EIS or effects greater than those described in this EIS, a separate environmental process would be conducted.

## **Soils**

### **General**

S-1. Individual burn plans would be written with enough detail to determine the extent of impacts to soil from erosion. Subject matter experts would determine if the erosion control plan submitted is sufficient to prevent long-term moderate or major impacts on the rate of soil erosion. In other words, the expert would determine if the proposed erosion control strategy would be sufficient to ensure no greater than minor impacts to soils from erosion. If the assessment finds that standard erosion control strategies would be insufficient to avoid long-term moderate or major effects on the rate of erosion, a separate NEPA process would be initiated for that burn plan. Strategies used to minimize impacts to soils could include avoiding steep slopes, timing burns to minimize erosion potential, or using erosion control devices during or after burns.

S-2. Watershed level planning would be used to assure that erosion rates within any one watershed would conform to the conclusions of environmental effect reached in this DEIS, (e.g., impacts would be no more than moderate in intensity). Watershed level planning would be triggered when proposed actions have potential to exceed 10% of the total area of one or more FMP watersheds in one year. This mitigation measure assures that planning considers the watershed scale, and if a potential effect is identified, that a specific assessment be conducted for the burn plan to assure the conformance of watershed level effects with this DEIS.

### **For Prescribed Burns**

S-3. Some coarse, woody debris, if available, would be left on the site for nutrient cycling and mycorrhizal function.

S-4. All constructed fire lines would be rehabilitated to prevent compaction if needed.

### **For Mechanical Treatments**

S-5. Mechanical regrading of roads would be conducted to specifications identified in the PRNS Trails Inventory and Condition Assessment and Road Memorandum of Understanding with adjacent land management agencies. Use of these specifications would minimize erosion from fire roads.

S- 6. For FMP tree removal actions in areas with highly erosive soils or slopes over 15%, tree stumps would be left in place and cut as close to ground surface as feasible.

#### For Wildland Fire Control Activities

S-7. Following wildland fires, soil rehabilitation efforts would be focused on rehabilitating ground disturbance from heavy equipment.

S-8. Unless no feasible alternative is available, heavy equipment would not be used in areas where soils are wet or extensive compaction could occur. If staging of equipment or supplies occurs on soils, a clearly marked and visible limit of disturbance line would be installed using either stakes, flagging, or fencing. Surface soils in areas subjected to compaction would be scarified at the end of the period of use to retard runoff and promote revegetation.

S-9. Erosion control measures would be implemented where project actions could leave soils exposed to runoff prior to revegetation. Erosion control measures include covering exposed soils with weed-free chipped material, native duff, erosion control blankets or certified sterile rice straw.

S-10. Where surface soils must be disturbed and soils support native vegetation, existing vegetation and topsoil would be retained and reinstalled whenever feasible.

### **Air Quality**

A-1. If recommended by BAAQMD, prescribed burn plans submitted for review could be modified to reduce production of pollutants. Options include modifying burns to reduce the area burned, reducing fuel loading (e.g., mowing and understory thinning ), or managing fuel consumption. Treatments to reduce overall air emissions from prescribed burns could include:

- Mowing grass and reducing density of vegetation in brushlands.
- Mechanical treatment of forested areas by removing standing or downed trees, understory thinning, thinning of forests, and creation of shaded firebreaks.
- More frequent, less intense burns to prevent unwanted vegetation from becoming established in clearings or in forest understory.

A-2. Increasing combustion efficiency or shifting the majority of combustion away from the smoldering phase and into the more efficient flaming phase would reduce emissions (except NO<sub>x</sub>, which is produced in greater quantities at higher temperatures). Methods to accomplish this would include pile or windrow burning, rapid mop-up, and shortened fire duration. Pile or windrow burning would generate more heat and burn more efficiently and be most effective in reducing forest fuel rather than brush type fuels.

A-3. The park would develop a Smoke Communication Strategy to guide management of smoke events during prescribed fires, managed wildland fires, suppression actions, and fires occurring outside the park. Notification of proposed burns would be disseminated through local media and postings to provide adequate advance notice to persons with sensitivities to smoke when burning is planned. Information would be provided to visitors, employees, and residents in smoke affected areas regarding health issues and concerns. The park would monitor particulate levels in the park during large smoke events to provide data for future assessments.

A-4. PM<sub>2.5</sub> monitoring data would be collected at Bear Valley in the Point Reyes National Seashore. Data collected would be shared with local, regional, and national air quality agencies and databases.

A-5. To reduce smoke and pollutant generation during late summer and early fall, efforts would be made to burn fuel concentrations, piles, landings, and jackpots outside of the prescribed burning season to increase the number of units that can be burned without overloading the airshed on days with good dispersal conditions.

A-6. To avoid impacts to visibility in the Class I PRNS portion of the project areas, burning would be avoided on holidays or other periods when recreational visitation is typically high.

A-7. To avoid public health and nuisance impacts to neighboring communities, prescribed burns would be conducted under meteorological conditions that would avoid smoke drift into sensitive residential areas and that would transport smoke away from populated areas. Planning for prescribed burning also would consider the smoldering period to avoid fires where downslope winds during the night could carry smoke into residential areas at the base of ridges.

## **Water Quality and Water Resources**

W-1. Individual burn plans would be written with enough detail to determine the extent of erosion within the burn area due to a) the prescribed burn and/or, b) mechanical treatments. Subject matter experts would determine if the erosion control plan submitted is sufficient to prevent long-term moderate or major impacts to the water resources and water quality. Strategies to minimize erosion and sediment transport to water resources associated with prescribed burning include avoiding oversteep slopes, timing burns to minimize erosion potential, or using erosion control devices after burns. Strategies to minimize erosion and sediment transport to water resources associated with mechanical treatment include avoiding oversteep slopes, avoiding scraping or clearing to bare mineral soil (leave duff layer), or installing erosion control devices as part of mechanical treatment (if necessary).

W-2. Watershed level planning would be used to assure that prescribed burning and/or mechanical treatment within any one watershed would conform to the conclusions of the environmental effect reached in this EIS (e.g., the impacts would be no more than

moderate in intensity). Watershed level planning would be triggered when proposed actions have the potential to exceed 10% of the total area of one or more FMU watersheds in one year. This mitigation measure assures that planning considers the watershed scale and, if a potential effect is identified that a specific assessment be conducted for the burn plan to assure the conformance of the watershed level effects within this EIS.

W-3. Helispots, staging areas, and spike camps would be located at least 100 feet away from streams, creeks, and other water bodies.

W-4. All fireline (both handline and dozer line) would be rehabilitated as quickly as possible, which would include application of Burned Area Emergency Rehabilitation (BAER) techniques such as recontouring, soil stabilization as needed, and monitoring for erosion and treatment as necessary in the first winter following disturbance.

W-5. When developing prescribed burn boundaries, non-treatment buffer areas would be established around perennial, intermittent, and ephemeral channels associated with Lagunitas Creek, Olema Creek, Pine Gulch Creek, and other coastal drainages originating from Inverness Ridge. Some treatment within buffer areas, including hand removal of non-native species and “cool” burns of non-native grasses, may occur within these areas. Fire lines around these areas would be mowed - not graded or scraped - in order to leave a 100-foot vegetated buffer strip from burn areas.

## **Vegetation**

The following mitigation measures would be applied to reduce impacts from prescribed fire and mechanical treatment within all vegetation types:

### **V-1. “Pre”-Treatment Measures**

- Individual prescribed burns would be conducted within the framework of a multidisciplinary planning effort. Personnel from fire management and from resource management would work together to identify areas that are expected to benefit from prescribed burning. Existing data on the response of plant communities in the Seashore to fire would be consolidated and analyzed to determine optimal areas, configurations, and times for burns. Clear objectives would be developed for prescribed burns that would include measurable parameters to determine the effects of the burns on vegetation. Following burns, vegetation would be analyzed to determine the effects of the burn, which would aid in future burn planning.
- Prescribed burns would be conducted at a time of year when introduction or spread of non-native plants would be minimized, and mortality of non-native plant species would be maximized.
- Whenever possible, existing roads or trails would be used as firebreaks for prescribed burns and for wildland fire suppression.

- Vegetation managers would work with fire management staff to develop maps of areas that support plant communities of special management concern (e.g., uncommon communities, wetlands, riparian areas, dunes, areas with no non-native plants that need to be kept intact, areas with highly invasive non-native plants that should not be spread) so fire personnel can attempt to avoid such areas when making decisions about fire management tactics.

#### V-2. “During” Treatment Measures

- Soil disturbance would be minimized to the greatest extent possible to reduce potential for introduction or spread of invasive non-native plant species.
- The aerial extent of disturbance associated with mechanical treatments would be kept to the minimum necessary to reduce fire risk.
- For helispots or spike camps, previously disturbed sites and open areas would be used whenever possible to minimize additional disturbance.
- Burn piles would be kept small to minimize the area disturbed and to allow for the recolonization of sterilized patches by mycorrhizal fungi and other soil organisms in adjacent areas.

#### V-3. “Post”-Treatment Measures

- Areas subject to fire management treatments would be monitored periodically for the presence of invasive non-native plant species, and if such species have established or spread as a result of such activities, the non-natives would be removed.
- All fireline (both handline and dozer line) would be rehabilitated as quickly as possible, which would include application of Burned Area Emergency Rehabilitation (BAER) techniques such as recontouring, soil stabilization as needed, and monitoring for and removal of invasive non-native plant species for a minimum of three years following a fire.

#### V-4. In grasslands

- Follow-up non-native plant monitoring and removal would be conducted to remove new recruits that come into the site in years following prescribed burning or mechanical treatments.
- All grassland burns would be carefully monitored to ensure burn objectives (= recruitment and long-term maintenance of native species without introduction of invasive non-native plant species) are being met.

- To enhance grassland plant species composition, and reduce the chance of invasion or spread of non-native species, native seeding trials would be conducted following fire management treatments in some areas.
- In Alternative C, small pilot burns (less than 100 acres) would be conducted in the Tomales Point FMU grassland to determine plant community response. These burns would be carefully monitored to ensure burn objectives (= recruitment and long-term maintenance of native species without introduction of invasive non-native plant species) are being met. If pilot projects determine objectives can be met using prescribed fire, individual burn size would increase to a maximum of 150 acres.

#### V-5. In Bishop pine

- Follow-up non-native plant monitoring and removal would be conducted to remove new recruits that come into the site in years following prescribed burning or mechanical treatments.
- Prescribed burning in Bishop pine stands would occur only if the burns can be conducted under conditions that would result in germination and recruitment of new stands of Bishop pine. Relatively cool fires under moist conditions may not meet this objective.
- Initially, prescribed burns in Bishop pine forest habitat would be small and would be carefully monitored to ensure burn objectives (= recruitment and long-term maintenance of Bishop pine and associated native species without introduction of invasive non-native plant species) are being met.

#### V-6. In Douglas-fir/coast redwood forests

- If pre-burn thinning of trees is required in forested stands, the trees to be thinned would be no larger than 10" in diameter.
- Prior to conducting prescribed burning in Douglas-fir or coast redwood forests, Seashore fire and vegetation managers, and wildlife and plant ecologists would collaborate to fully develop rationale, objectives, prescriptions, and plans for conducting burns in the redwood forests within the project area.

#### V-7. In hardwood forests

- Site-specific objectives would be developed for prescribed burns in hardwood forest habitat. The intent of such burns may be to reduce density or abundance of this vegetation type to encourage coastal scrub development, or may be to enhance the ecological health of the hardwood plant communities. Unique, site-specific burn prescriptions and timing would be required to meet these differing objectives.

#### V-8. In coastal scrub

- In coastal scrub small pilot burns (> 50 acres) would be conducted. These burns would be carefully monitored to ensure burn objectives (= recruitment and long-term maintenance of native species without introduction of invasive non-native plant species) are being met. If pilot projects determine objectives can be met using prescribed fire, individual burn size would increase to a maximum of 200 acres.

## **Wetlands**

W-1. Burns would be allowed to back into and burn around wetlands and meadows or through them if the vegetation is dry enough to carry fire. Wetlands would be avoided to the greatest extent possible during fire confinement and containment.

W-2. Fire suppression activities would not occur in wetlands unless there are no alternatives available to control the spread of a wildland fire.

W-3. Fires near wetlands would be ignited when wetlands are too moist to sustain fire spread, thereby minimizing impacts to wetlands.

W-4. To the greatest extent possible, mechanical treatments would not occur in wetlands.

W-5. Wetlands may be used as natural boundary for prescribed fires. When a wetland area is being used as a boundary, the control line would occur in adjacent uplands, not in wetlands.

W-6. Prescribed fires would not occur more frequently than the time required for native plant species to set seed.

W-7. Foams or other fire retardants would not be used in or near wetlands.

W-8. Firebreaks or firelines would be constructed in previously disturbed areas whenever possible.

W-9. Chipped material would not be spread in wetlands.

## **Special Status Species**

SS-1. Known populations of special-status plant and animal species would be monitored to ensure long-term impacts are avoided. Known populations of special status species would be avoided when locating helispots or spike camps.

SS-2. In Spotted Owl Habitat

- annually identify and map areas where spotted owls are nesting,
- protect occupied and previously used nest sites from unplanned ignitions,

- do not conduct prescribed burns within 400 meters of an occupied or previously used nest site,
- do not conduct mechanical treatments with mechanized equipment within 400 meters of an occupied or previously used nest site between February 1 and July 31 (breeding season),
- conduct post-treatment monitoring to ascertain any impacts.

#### SS-3. In Point Reyes Mountain Beaver Habitat

- identify and map areas known to support Point Reyes mountain beaver and areas that have habitat suitable for supporting Point Reyes mountain beaver,
- protect known and potential habitat from unplanned ignitions,
- establish buffer areas 30 feet wide around known habitat areas,
- conduct small burns (less than 100 acres) of mountain beaver habitat each year.

SS-4. Avoid conducting burns during the nesting season, March 15 through August 15, unless biologists can ascertain that birds are not nesting in the planned burn area.

SS-5. During the tule elk calving seasons, burns would be conducted in habitat away from areas where birthing and loafing of females and calves occur.

SS-6. To protect California red-legged frogs, areas to be treated by mechanical means or prescribed fire would have a buffer area of 30 feet established around known breeding habitat.

### **Cultural Resources**

#### CR-1. Pre-Action

- Cultural resources would be considered during all fire management planning efforts.
- Fire management personnel and other staff would receive annual training on cultural resources and fire management actions.
- All cultural resources would be evaluated with respect to hazardous fuel loads. As needed, fuel loads would be reduced using methods commensurate with avoiding or minimizing adverse effects. Maintaining light fuel loads on and in close proximity to cultural resources would be emphasized. All areas slated for ground disturbing activities would be subjected to pre-action field surveys. This includes areas likely to be disturbed during future wildfires.

- Pre-burn survey would be conducted prior to all prescribed burns as dictated by resource distribution and vulnerability, vegetation and topography, and expected fire behavior.
- Consultation with local Native American communities would continue to occur in the context of fire management actions. Spiritual sites and important plant communities would be identified and appropriately managed for preservation, maintenance, and/or enhancement.
- Computer and other databases containing cultural resources data would be created and maintained, and made available to fire management personnel in the event of emergencies.
- Cultural resources specialists from adjacent land management agencies would be consulted in order to coordinate mitigation efforts prior to planned and unplanned fire management actions.
- Appropriate cultural resources monitoring protocols would be established and implemented.
- Potential research opportunities to study the effects of fire management actions on cultural resources would be identified.

#### CR-2. During-Action

- A cultural resource specialist or resource advisor would be present during all fire management actions where recorded and unrecorded resources of interest are considered at risk. Additional survey would be conducted on an as-needed basis.
- Observations of fire behavior and other variables would be made with respect to recorded cultural resources and/or areas with high probability of containing unrecorded cultural resources.
- Cultural resources data would be shared with fire management personnel as needed to avoid or minimize adverse effects.
- A cultural resource specialist or resource advisor would educate fire management personnel about cultural resources and the potential impacts of fire management actions.

#### CR-3. Post-Action

- The post-action condition of all recorded cultural resources would be assessed. Resources requiring stabilization or other treatment would be mitigated.

- As appropriate, post-action survey would be conducted in previously surveyed and unsurveyed areas. Previously unrecorded cultural resources would be assessed for condition, and stabilization and other protection needs.
- Monitoring and research data would be compiled, evaluated, and used to help refine cultural resource compliance for fire management actions.

## **Human Health and Safety**

HH-1. Firefighters would be frequently rotated and allowed to rest or sleep when needed, and firelines and safety zones would be used to minimize exposure.

## ***Alternatives Considered But Not Analyzed Further in This DEIS***

### **Allow Wildland Fires to Burn without Human Intervention**

This alternative was considered initially to determine the associated extent of impacts and resource benefits. Although wildland fire would result in substantial ecological benefits in many areas of the Seashore, the risk of significant adverse impacts to lives, property and resources would increase to an unacceptable level. In other words, meeting the FMP goal of protecting private and public property could not be guaranteed. Allowing uncontrolled burning also could violate a number of state and federal resource laws (e.g., Clean Air Act). For these reasons, this alternative was not analyzed further.

### **Apply Mechanical Treatments Only**

The park uses mechanical treatments, including mowing, grazing and selective thinning, to remove hazardous fuels around buildings and along travel corridors. Use of these methods throughout the entire park is not possible due to federal laws (e.g., Wilderness Act) and unacceptable adverse impacts to natural resources. Much of the park that is not currently in the Pastoral Zone is rugged and without access. To mechanically treat these areas would require extensive labor and use of equipment incompatible with land use. Additionally, many of the species and ecosystems in the Seashore depend on periodic fire for their survival, and mechanical treatments cannot substitute for burning. For these reasons, this alternative was not analyzed further.

### **Create Wildland Fire Use Zone for Philip Burton Wilderness Area**

This alternative was considered initially to meet objectives of the 1999 Resource Management Plan - to protect and perpetuate the diversity of natural ecosystems and to manage as wilderness those lands so designated. Upon further consideration, however, it was recognized that defensible boundaries to contain fires within the wilderness do not exist, and the risk of adverse impacts to lives, property and resources would be unacceptable. For these reasons, this alternative was not analyzed further.

## ***The Environmentally Preferred Alternative***

National Park Service policy regarding implementation of the National Environmental Policy Act (NEPA) requires that an environmentally preferred alternative be identified in all NEPA analysis documents. Determination of this alternative takes place after the environmental analysis is complete. The environmentally preferred alternative is the alternative that best promotes the national environmental policy expressed in Section 101 of NEPA. This includes alternatives that would:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Assure for all visitors a safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
- Achieve a balance of population and resource use which would permit high standards of living and a wide sharing of life's amenities; and
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Essentially, this means the environmentally preferred alternative is the one that causes the least damage to the biological and physical environment or most naturally perpetuates biological or physical process; it also means the alternative which is best suited to protect, preserve, and enhance historic, cultural and natural resources and process. After analyzing the alternatives described in this DEIS, the National Park Service has determined that Alternative C is environmentally preferred. Alternative C includes fire management treatments that would provide a high level of protection of human health, life and property, while maximizing efforts toward restoring and maintaining ecological integrity, and protecting and enhancing cultural resources (e.g., preserving important historic, cultural and natural aspects of our national heritage). Although Alternative B also would provide a high level of protection of life and property, it would not provide the same benefits to natural and cultural resources. Of the three alternatives, Alternative A (No Action) would provide the lowest degree of protection of lives and property, and minimal benefits to natural and cultural resources.

National Park Service policy also directs that all environmental analysis documents address compliance with Section 102(1) of NEPA. This section states that the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forward in NEPA. This document was written in support of National Park Service Fire Policy and other policies and legislation governing management of National Park sites in accordance with NEPA.

## ***The Preferred Alternative***

Alternative C has been selected as the alternative preferred by the National Park Service. The Superintendent has reviewed the DEIS and has evaluated the three alternatives with respect to how well they meet the fire program objectives, and their beneficial and adverse impacts on all resource topics (Table 5). Alternative C offers the best combination of benefits, with a high level of protection of life and property, and greater long and short-term natural and cultural resource benefits than either Alternatives A or B.

Table 5. Range of FMP Alternatives Compared by Fire Management Goals

<b>Goals</b>	<b>Alt. A</b>	<b>Alt. B</b>	<b>Alt. C</b>
Protect firefighters and the public	2	2	3
Protect private and public property	1	2	3
Maintain or improve conditions of natural resources and protect these resources from adverse impacts of wildland fire and fire management practices	2	2	3
Maximize efforts to protect cultural resources from adverse effects of wildland fire and fire management practices	2	3	3
Foster and maintain effective community and interagency fire management partnerships	3	3	3
Foster a high degree of understanding of fire and fuels management among park employees, neighbors, and visitors	2	3	3
Improve knowledge and understanding of fire through research and monitoring and continue to refine fire management practices	2	2	3

1 - Partially Meets Goal

2 –Meets Basic Level of Goal

3 –Provides Highest Levels of Goal Achievement

Table 6. Summary of Preferred Alternative and Alternatives

	<b>Alternative A: No Action Continued Fuel Reduction for Public Safety and Limited Resource Enhancement</b>	<b>Alternative B: Expanded Hazardous Fuel Reduction and Additional Natural Resource Enhancement</b>	<b>Alternative C: (Preferred) Increased Natural Resource Enhancement and Expanded Hazardous Fuel Reduction</b>
<b>Prescribed Fire</b>	500 acres would be treated annually with prescribed fire to reduce fuel loads.	1000 acres would be treated with prescribed fire to reduce fuel loads and conduct natural and cultural resource enhancement.	2,000 acres would be treated with prescribed fire to reduce fuel loads and conduct natural and cultural resource enhancement.
<b>Mechanical Treatments</b>	500 acres would be treated annually with mechanical means to reduce fuel loads.	1000 acres would be treated annually with mechanical means to reduce fuel loads and conduct resource management enhancement.	1,500 acres would be treated annually with mechanical means to reduce fuel loads and conduct resource management enhancement.
<b>Fire Management Units Treated by Alternative</b>	<p>A total of four (4) FMUs would be treated.</p> <p>Prescribed Fire FMUs (4): Estero, Limantour Road, Highway One, and Bolinas Ridge.</p> <p>Mechanical treatment FMUs (3): Estero, Limantour Road, and Highway One.</p>	<p>A total of nine FMUs would be treated.</p> <p>Prescribed Fire FMUs (8): Estero, Inverness Ridge, Limantour Road, Wilderness North, Wilderness South, Highway One, Bolinas Ridge, and Palomarin.</p> <p>Mechanical treatment FMUs (8): Tomales Point, Estero, Inverness Ridge, Limantour Road, Wilderness North, Wilderness South, Highway One, and Palomarin.</p>	<p>A total of ten (10) FMUs would be treated.</p> <p>Prescribed Fire FMUs (10): Tomales Point, Headlands, Estero, Inverness Ridge, Limantour Road, Wilderness North, Wilderness South, Highway One, Bolinas Ridge, and Palomarin.</p> <p>Mechanical treatment FMUs (8): Tomales Point, Estero, Inverness Ridge, Limantour Road, Wilderness North, Wilderness South, Highway One, and Palomarin.</p>
<b>Total Acres in the FMUs to be Treated During Life of Plan (some acres may be treated more than once to ensure fuel reduction)</b>	10,865	20,620	21,419
<b>Wildfire Suppression</b>	Current policy is to suppress all unplanned ignitions using minimum impact suppression tactics to the greatest extent possible.	Same as Alternative A	Same as Alternative A
<b>Fire Education</b>	A comprehensive program of information and education would be conducted to ensure public knowledge	Same as Alternative A.	Same as Alternative A.

	and understanding of prescribed burns and other treatments. NPS would work with local fire districts to encourage defensible space.		
<b>Fire Cache Construction</b>	A fire cache would be constructed at Bear Valley (park headquarters) to facilitate fire management program.	Same as Alternative A.	Same as Alternative A.
<b>Fire Effects and Fuel Management Research</b>	Fire effects program would continue and research on velvet grass and Scotch broom would continue.	Same as Alternative A.	Same as Alternative A, but expanded research on a variety of topics to guide expansion of resource enhancements projects.

Table 7- Summary of Impacts of Alternatives

	<b>Alternative A: No Action Continued Fuel Reduction for Public Safety and Limited Resource Enhancement</b>	<b>Alternative B: Expanded Hazardous Fuel Reduction and Additional Natural Resource Enhancement</b>	<b>Alternative C: Preferred Increased Natural Resource Enhancement and Expanded Hazardous Fuel Reduction</b>
<b>Soils</b>	Prescribed burning would result in negligible to minor increases in erosion and changes soil productivity and chemistry	Burn plans would be used to ensure increased erosion would affect no more than 10% of soils in a watershed; impacts would be no more than minor	Same as Alternative B
	Moderate to major short to long-term impacts to soils from a catastrophic wildland fire from erosion, hydrophobic soils, slope failure, suppression	Same as Alternative A	Same as Alternative A
	Negligible impacts to soils from their removal to build the fire cache would occur	Same as Alternative A	Same as Alternative A
<b>Air Quality</b>	Particulate emissions from all fire management activities would have a negligible long, term, adverse effect on regional haze.	Fire management activities would produce 2.86 pounds of particulates per acre—about twice that of Alternative A and a minor long-term, adverse impact to regional haze.	Fire management activities would produce 5.3 pounds of particulates per acre and a moderate, long-term adverse impact on regional haze
	The ongoing risk of a large wildfire and associated major adverse impacts to air quality would remain high.	Treatment would reduce the risk of a catastrophic wildfire and offer possible short-term major benefits to air quality as a result.	Same as Alternative B, although the risk of wildfire would be even lower.
	Negligible short-term impacts to air quality from the use of construction equipment to build the fire cache would occur.	Same as Alternative A	Same as Alternative A
<b>Water Resources and Water Quality</b>	Increases in erosion from hydrophobic soils, loss of vegetation and ash from prescribed burning would increase suspended solids, with negligible to minor impacts to water quality.	Same as Alternative A, although impacts would be more likely to be minor than negligible.	Same as Alternatives A and B, although impacts would be the most adverse of any alternative.
	Trampling and removal of vegetation from mechanical thinning or suppression of small wildfires could increase erosion and have negligible, localized short-term adverse impacts to water quality	Impacts would be minor.	Impacts would be minor and greater than Alternatives A or B.

	Large wildfires could have major adverse impacts on water quality and watershed from increased erosion and destruction of vegetation, including riparian vegetation.	Same as Alternative A	Same as Alternative A
	Treatment with mechanical thinning and prescribed burning would reduce the risk of catastrophic fire and have potential moderate benefits to watersheds and water quality.	Potential moderate to major benefits to watershed and water quality from a reduction in fuel loading and resulting decreased risk of catastrophic wildfire.	Same as Alternative B, although the benefits would be more likely to be major.
	No impacts to any water quality or watershed resource from building the fire cache would occur.	Same as Alternative A	Same as Alternative A
<b>Vegetation</b>	Minor, short-term impacts from the spread of non-native plants following prescribed fire are possible	Same as Alternative A	Same as Alternative A
	Minor to moderate beneficial impacts to native fire dependent vegetation from stimulating growth and killing non-native plants	Moderate benefits	Moderate benefits, but greater than Alternative B
	Crushing or shearing from mechanical equipment or trampling could have short-term minor adverse impacts	Same as Alternative A	Same as Alternative A
	Minor to moderate benefits from clearing dense vegetation through mechanical treatment	Moderate benefits	Moderate benefits, but greater than Alternative B
	Minor to moderate benefits would occur to native scrub and forest vegetation from removing Monterey pine and Monterey cypress trees	Same as Alternative A	Same as Alternative A
	Minor to moderate benefits to coastal scrub from the removal of scotch broom with prescribed fire and additional moderate to major benefits from removing scotch and french broom with mechanical treatment.	Moderate benefits from prescribed fire and major benefits from mechanical treatment.	Moderate benefits from prescribed fire, but greater than Alternative B; major benefits from mowing, but larger than Alternative B.
	No plans to burn in these FMUs to increase species richness	Minor benefits to coastal scrub from prescribed burning in Bolinas and Palomarin to increase species richness	Same as Alternative B
	Prescribed burning in grasslands may have minor adverse impacts or benefits, depending on reaction of native and non-native species	Same as Alternative A, although benefits or adverse impacts may be greater (they would remain minor)	Same as Alternative B, although benefits or adverse impacts may be greater (they would remain minor)
	Negligible benefits to hardwood, Douglas fir or Bishop pine forests from decreased fuel loads	Minor to moderate benefits	Moderate benefits

	No plans to aggressively treat in Douglas fir forest	Same as Alternative A	Possible major benefits to Douglas fir forests from returning natural fire intervals following treatment
	Cumulative impacts of catastrophic fire, historic logging, development and disease have been major, long-term and adverse. This would continue.	Same as Alternative A, although the risk of a catastrophic fire would decrease.	Same as Alternative B, although the risk of a catastrophic fire would decrease further.
	Negligible impacts to scrub, forest or grassland vegetation may occur from removing them to build the fire cache, although the cache is to be located in an area that is already disturbed.	Same as Alternative A	Same as Alternative A
<b>Wetlands</b>	Short-term minor adverse impacts from inadvertent burning to non-adapted wetland vegetation during prescribed burns.	Same as Alternative A	Same as Alternative A
	Minor to moderate short to long-term benefits from inadvertent burning of adapted wetland vegetation or of exotics in wetlands from prescribed fire possible	Same as Alternative A	Same as alternative A, although more likely to be moderate than minor
	Minor short-term adverse impacts from suppression of average sized wildfires, and minor positive or negative impacts to vegetation from fires.	Same as Alternative A	Same as Alternative A
	Mechanical treatment in wetlands usually avoided; however if needed it may have negligible to minor short-term adverse impacts from trampling, or minor benefits from clearing exotics	Same as Alternative A, although adverse impacts more likely to be minor.	Same as Alternative B, although adverse impacts could be greater.
	Cumulative impacts from development and catastrophic fire could have major, long-term adverse impacts from destruction of vegetation, invasion of exotic species	Same as Alternative A	Same as Alternative A
	No wetlands would be disturbed or removed in building the fire cache.	Same as Alternative A	Same as Alternative A
<b>Wildlife</b>	Fire management activities would have a minor short or long-term benefit by creating more open wildlife habitat and reducing the risk of catastrophic fire	Moderate benefits compared to Alternative A	Moderate to major benefits compared to Alternative A
	Minor short-term impacts from suppression of average sized wildfires would continue.	Impacts would remain minor, but be greater than Alternative A	Impacts would remain minor, but be greater than all alternatives
	Minor adverse impact to forest dwelling species from treatment	Minor to moderate impacts compared to Alternative A	Minor to moderate impacts compared to Alternative A
	Cumulative impacts of development, habitat alteration and a catastrophic fire, should it occur, would all have major, long or short-term adverse impacts on wildlife.	Same as Alternative A	Same as Alternative A

	Short-term, minor adverse impacts on wildlife in the vicinity of the planned fire cache could occur during construction from noise and the presence of humans	Same as Alternative A	Same as Alternative A
<b>Special Status Species</b>	No federally listed plants would be affected, as all known populations lie in the Minimum Management Zone, where treated is not planned.	Same as Alternative A	Same as Alternative A
	Plant species of concern would likely continue to experience minor landscape scale benefits from fire management activities	Benefits would increase, but remain minor	Benefits would be the greatest of the alternatives, but remain minor
	Plant species of concern may experience minor adverse effects from destruction, or inadvertent stimulation of exotic species during prescribed burns	Same as Alternative A	Same as Alternative A
<b>Spotted owls, red-legged frogs, California freshwater shrimp</b>	Treatment would offer negligible to minor, long-term benefits to northern spotted owls, red-legged frogs and California freshwater shrimp from a reduction in the risk of catastrophic fire	Minor benefits	Moderate benefits
	Hand thinning and pile burning could have minor short-term effects to spotted owls from disturbance, and on red legged frogs from inadvertently crushing them	Same as Alternative A	Same as Alternative A
	Cumulative effects of a large-scale wildfire would be long-term, major and adverse on spotted owls and red-legged frogs	Same as Alternative A	Same as Alternative A
<b>Coho salmon and steelhead trout</b>	Fire management would not normally take place in riparian vegetation, so impacts to coho salmon and steelhead trout would be inadvertent, and remain negligible to minor.	Same as Alternative A	Same as Alternative A
	Negligible positive benefits to coho and steelhead from reducing the risk and intensity of a catastrophic fire	Same as Alternative A	Same as Alternative A
	Siltation of streams and loss of riparian vegetation would have minor to major impacts	Same as Alternative A	Same as Alternative A
<b>Myrtle's silverspot butterfly and snowy plovers</b>	Myrtle's silverspot butterfly and snowy plovers occur in the Minimum Management Unit, where fire management activities are not anticipated. No impact from the FMP would occur	Same as Alternative A	Same as Alternative A
<b>Pt. Reyes Mountain Beaver</b>	Minor impacts to Point Reyes mountain beaver from fire management activities, including suppression of average sized wildfires would occur	Same as Alternative A	Same as Alternative A
	Large-scale wildfires could have short to long-term moderate to major adverse impacts from habitat destruction, and direct and indirect killing of animals	Same as Alternative A	Same as Alternative A
	No impact to any listed plant or animal species would occur from construction of	Same as Alternative A	Same as Alternative A

	the fire cache		
<b>Cultural Resources</b>	Moderate benefits to historic buildings by reducing fuel building through fire management activities would occur	Benefits would remain moderate, but be greater than in Alternative A	Benefits would remain moderate, but be the greatest of any alternative
	Minor adverse impacts from ground disturbance associated with pre-treatment or mechanical thinning could occur	Impacts would remain minor, but be greater than in Alternative A	Moderate
	Moderate long-term benefits to cultural landscapes from the use of prescribed burning or mechanical treatment possible	Benefits would remain moderate, but be greater than in Alternative A	Benefits would remain moderate, but be the greatest of any alternative
	Suppression of average sized wildfires or of larger wildfires could have unknown negligible to major, permanent adverse impacts to cultural resources. Large wildfires could also destroy cultural resources.	Same as Alternative A	Same as Alternative A
	No impacts from construction of the fire cache are anticipated	Same as Alternative A	Same as Alternative A
<b>Visitor Use and Visitor Experience</b>	Minor positive impacts from prescribed fire on visitor experience by opening scenic vistas	Same as Alternative A	Same as Alternative A
	Minor adverse effects on visitors from the site of blackened vegetation from prescribed burning	Same as Alternative A	Moderate impact on visitors possible
	Minor impact on visitor use from closures during prescribed burn	Impact is greater than Alternative A, but remains minor (up to 30 days/year)	Moderate impact of up to 50 days of closures
	Minor impact to visitor use and experience from closures and noise during mechanical treatment.	Impact is greater than Alternative A, but remains minor	Moderate impact possible
	Minor short-term adverse impact to visitors from noise and dust associated with construction of fire cache	Same as Alternative A	Same as Alternative A
	Major, short to long-term adverse impacts on visitor use and visitor experience possible from large-scale wildfire	Same as Alternative A	Same as Alternative A
<b>Park Operations</b>	Fire management operations require 13 staff and account for about 15% of the park budget	A 3.8% increase in funding and staffing would be required, a minor impact	A 5.9% increase in funding and staff would be required, a minor impact
	Funding the fire cache would have a short-term negligible adverse impact on the park's budget, but would have long-term minor benefits in terms of increased staff efficiency.	Same as Alternative A	Same as Alternative A
	Suppression of a large-scale wildfire would have short-term, major adverse impacts on park operations, management and budget	Same as Alternative A	Same as Alternative A

<b>Public Health and Safety</b>	Impacts from prescribed burning and mechanical thinning on human health and safety, including the public and firefighters would be short-term and minor.	Same as Alternative A	Same as Alternative A
	Large, severe wildfires could have major adverse effects on the risk and impacts from smoke or fire to public and firefighter health and safety	Same as Alternative A	Same as Alternative A
	Negligible benefits from the reduction in risk or intensity of a large wildfire	Moderate benefits	Moderate benefits
	Completion of the fire cache would have minor benefits in increasing efficiency of response	Same as Alternative A	Same as Alternative A
<b>Socio-economics</b>	Minor benefits to the local economy from fire management program and staff spending	Same as Alternative A	Moderate benefits
	No or negligible impacts on local economy from loss of tourist dollars during closures from prescribed burning	Impacts would remain negligible, but be greater than Alternative A	Impacts would remain negligible, but be the greatest of all alternatives
	Negligible to minor impacts on local economy from loss of tourist dollars during closures from mechanical treatment	Impacts would remain negligible, but be greater than Alternative A	Impacts would remain negligible, but be the greatest of all alternatives
	Negligible, short-term impacts to the local economy from loss of tourist dollars during closures for suppression of average sized wildfires	Same as Alternative A	Same as Alternative A
	A large wildfire could have major, short to long-term adverse impacts on the local economy, loss of property, but possible major benefits from increases in local spending from suppression program needs and personnel	Same as Alternative A	Same as Alternative A